The Great Odontographic Society Meeting.

PROSTHODONTIA

Porcelain Crowns.*

By Hart J. Goslee, D.D.S.,
Chicago, Ill.

CHAPTER XII.

(Continued.)

(Variations in Construction: Reenforced Caps: Procedure. Without Band; Procedure, Plate and Dowel. Partial Bands; Procedure. Jacket Crowns; Indications for Porcelain Jackets. Procedure. Variation of Method. Use of the Davis and Logan Crowns; Advantages. Disadvantages. Application of the Davis Crown. With Band. Without Band. Application of the Logan Crown; Procedure.)

Variations in Construction.

Because of the acknowledged advantages of a band, the foregoing style of construction has been given precedence, and designated as the *typical* one; yet, while it is true that crowns so made are perhaps more universally applicable, and productive of more permanent results, it is also true that there are many variations of methods of more or less value, the employment of many of which may be frequently indicated.

Reenforced Caps.

As inherent strength in the metal parts has already been claimed as a *prerequisite* in this work, one of the most useful variations in the construction is to be obtained by reenforcing the cap in a manner similar to that previously recommended in the construction of crowns with the so-called saddle-back teeth.

Such a procedure imparts to the finished porcelain crown a degree of strength which is appreciably valuable in many cases; particularly in

bicuspid crowns, and in those cases where the crown is not supported by adjacent teeth on one or both sides, and where the absence of some of the opposing teeth necessitate more than average occluding stress.

This increased strength may be secured by allowing the floor to project slightly beyond the band upon the approximal and lingual surfaces, and then filling in the shoulder so formed with platinum solder until smooth and flush. The additional thickness of a cap so made further precludes the possibility of subsequent irritation to the surrounding tissue by affording a heavier, smoother and more rounding edge.

Procedure. In accomplishing this result, the procedure incident to the fitting of the band and construction of the cap is identical with that indicated in the preceding method, except that platinum solder should be used.

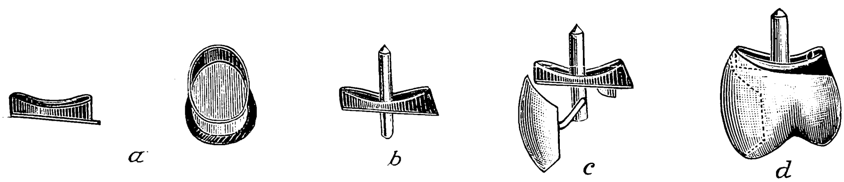


Fig. 189.

When the floor has been attached to the band, the surplus should be trimmed away until a projecting edge, from 1/16 to 1/32 of an inch, remains upon the *approximal* and *lingual surfaces.* The labial or buccal surface, however, must be trimmed flush and even with the band, in order to prevent an undue prominence of the neck of the facing, and to admit of properly overlapping it upon this surface of the band, both features of which are illustrated in Fig. 189, A.

The slight shoulder so formed should be filled in with 25 per cent platinum solder, until flush and even with the band, the edge then nicely rounded and the dowel fitted and soldered as usual. (Fig. 189, B.)

The completed cap, with the proper relation of the facing, is shown in Fig. 189, C, and the finished crown, with its apparent advantages, in Fig. 189, D.

Without Band.

That style of construction which involves simply the adaptation of a metal floor or base to the end of the root, and the attachment of a dowel and facing thereto, and which has previously been designated as the "plate and dowel" crown, is equally as applicable to porcelain work as to gold work.

Procedure. The indications and general principles, and the detail of procedure incident to the requirements of root preparation, and the construction of the base of the crown, are identically the same as previously outlined. The only exception is the variation which the completion of the crown with porcelain "body" instead of gold solder demands, and which includes the use of platinum and high-grade solder.

Plate and Dowel. Wherever a band is not desirable, for any reason, or where its use may be contraindicated, and the preference given to this style of construction, a plate of platinum about 36 gauge should be adapted to the end of the root, by burnishing or swaging, as indicated in Chapter X.

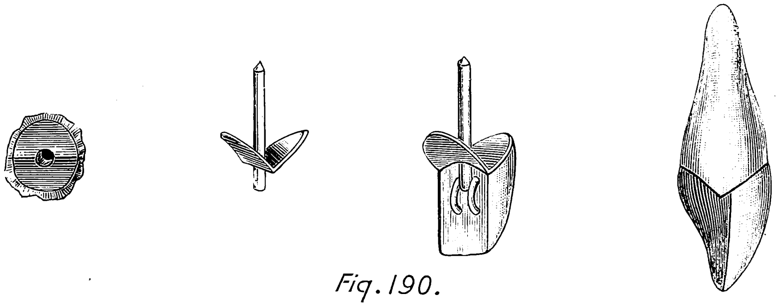


Fig. 190.

The dowel should then be soldered; the cap again adjusted to the root, and reburnished and properly trimmed around the edge, the models secured, and the facing attached by observing the requirements indicated in the immediately preceding style of construction, as are consecutively illustrated in Fig. 190. If the presence of this thin plate of platinum should be objectionable or conspicuous, it may be afterward removed by destroying its attachment to the dowel with a small round bur, carefully inserting the edge of a thin knife blade between it and the porcelain on the lingual surface, and gently lifting it away from the base of the crown. A slight deepening of the canal, or shortening of the dowel, will allow for its absence, and admit of placing the crown in close proximity with the root.

Partial Bands.

The employment of a partial band encircling only the approximal and lingual sides of the root, as a means of increasing the stability of the attachment of the crown, may also be made in a manner similar to that already mentioned.

As this style of construction serves to fortify the crown against stress

in the direction in which it is usually imposed, and also renders this porton of the joint between crown and root more or less immune to the penetration of secretions, it at once recommends itself as a useful practice, especially indicated on the six anterior teeth, where the root is allowed to project slightly beyond the gum line on the lingual side.

Procedure.

The effect of a partial band to serve such purposes may be obtained with the greatest degree of facility by allowing a sufficient surplus of the plate to extend beyond the root on this surface, until the adaptation of the base has been secured, and the dowel soldered.

The cap may now be adjusted to position on the root, where it is held firmly by the presence of the dowel, and this surplus edge then bur-

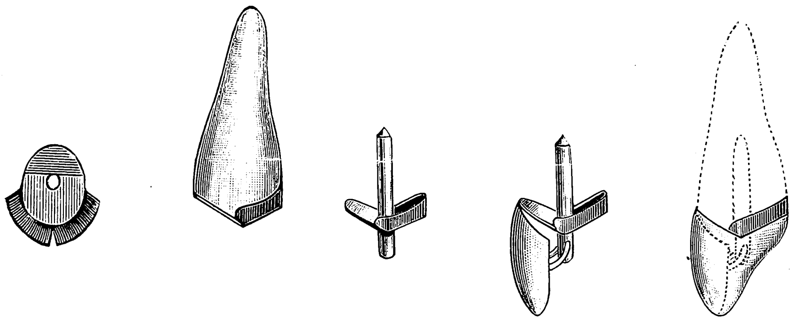


Fig. 191.

nished up close to the surface of the root, and finally trimmed to follow the curvature of the gum.

A surplus sufficient to admit of reaching the gum line, and passing just a bit beneath it, should always be allowed to remain, and if the accurate burnishing of this upturned edge is made difficult because of the length of the root, a slight incision through the surplus edge of the plate at the center of the lingual surface will facilitate the possible adaptation. This may be subsequently soldered, either before or after the impression has been taken, but should always be done before the porcelain is applied. More than one incision may be sometimes indicated, and are permissible when necessary.

The various steps in this style of construction are consecutively illustrated in Fig. 191.

Jacket Crowns.

The principles involved in the so-called "jacket" style of crown construction, as applied to both gold and porcelain work, have been else-

where considered, together with the indications, advantages and disadvantages governing their application.

The practicability of these crowns, however, when made in combination with porcelain, is apparently a question of much dispute, and has continued to be since the method, which was the primitive effort in the line of constructing porcelain crowns in combination with platinum, was first suggested by Dr. C. H. Land.

The advocates of this style of construction claim that it is more or less universally indicated in restoring the crowns of the six anterior teeth, upper and lower; and that the principal advantage lies in the conservation of tooth structure, and the preservation of the pulp.

While both of these considerations are always of material significance to the conscientious operator, and should be observed wherever possible, still they do not constitute the complete maximum of requirements of crown construction and application, even when combined with the highest esthetic possibilities, because the requirement of *strength* is, of course, of equal importance, having so great an influence upon the serviceability and permanency of the work.

In view of this fact, and also that the projecting end of the crown of the natural tooth, which is to be telescoped by the cap or "jacket," as a means of affording attachment for the artificial crown, is allowed to remain, or is preserved, at the expense of the thickness of porcelain which may be subsequently used in the construction of the crown; and, because of the *friable* nature of porcelain, particularly when used in small quantity, this style of construction is not to be recommended as a general or conservative practice, and is by no means universally applicable, if the most permanent results are desired.

In this connection, it seems more than probable that a large percentage of the early failures which marked the advent of the porcelain crown constructed for the individual case, and retarded the development of this work, may be attributed as much to the method of construction as to the use of the *low fusing bodies*, which were formerly employed.

Aside from the inherent weakness, which adequate accommodation for the root in the body of the crown demands, the artistic possibilities are also often somewhat hampered by the more or less clumsy appearance of the finished crown.

Indications for Porcelain Jackets.

Whenever *an adequate length of the adjacent teeth*, and a *favorable occlusion*, will admit of overcoming these objectionable features, and securing a maximum degree of strength, jacket crowns may be constructed with porcelain, producing serviceable and artistic restorations.

Procedure. In the application of this style of crown, the remaining natural crown should be favorably shaped to admit of the accurate adaptation of the jacket, and of the proper alignment of the facing, as indicated in the previous consideration, and illustrated in Fig. 192, A.

The measurement should be taken and a band of about 36 gauge platinum, wide enough to encompass the entire remaining natural crown, then made. The overlapping of the ends in this instance is not always advisable, because of the impediment offered to the burnishing by such additional stiffness.

When this has been accurately trimmed and fitted at the cervical edge, a cut in each *approximal* side of the band, beginning at the incisal and extending well toward the cervical edge, will facilitate the subsequent burnishing of the platinum into a close conformation with the root. A

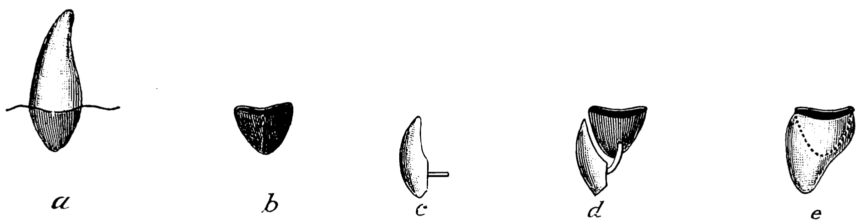


Fig. 192.

blunt piece of wood and a light mallet, or a smooth foot-plugger in an automatic mallet may be found useful in this procedure, but care should be exercised to avoid drawing the cap down from its proper cervical relation.

The edges should now be pinched together with pliers around the incisal end of the root until in close contact, the cap then removed, the surplus trimmed away, and the joints soldered. Pure gold will answer nicely for this purpose, if used *sparingly* and properly fused, though platinum solder is preferable.

Platinum foil, No. 60 or 120, may often be used in securing the proper adaptation around the cervix, and slightly beneath the free margin of the gum, to which point it should be carried, because of the greater facility with which it may be even more closely adapted; and extreme thinness of the cap, on the labial surface, at least, is also advantageous to the subsequent adjustment of the facing. In the use of the foil, however, when the proper adaptation has been secured by burnishing, with

the surplus overlapped upon the approximal and lingual surfaces, the cap should then be slightly re-inforced with platinum solder, or pure gold thoroughly fused.

The best results are doubtless to be obtained, as a general practice, from the use of the heavier cap, and while *pure platinum is not as soft and malleable as pure gold,* if the piece is well annealed in the porcelain furnace, as recommended, no great difficulty will be experienced in adapting platinum of 36 gauge to the requirements of these cases. If preferable, the adaptation may be secured by taking an impression of the end of the root, making dies and swaging, as previously described.

The entire surface of the cap, however made (Fig. 192, B), should now be slightly roughened with a sharp chisel, or other convenient instrument, to facilitate the attachment of the porcelain, and the impression taken with it in position on the root. Before filling the impression, the cap should be filled with wax to facilitate its subsequent removal from the model.

A very *thin* facing (Fig. 192, C) of the proper size and color should now be selected and ground to its proper adjustment. This sometimes requires that the entire lingual surface, including pins, be ground away until only a very thin *veneer* remains, but it is best to allow the pins to remain also, if possible, because of the advantage to be derived from their presence in securely sustaining the relation of the facing to the cap, by bringing them in contact and soldering, previous to applying the porcelain. (Fig. 192, D.)

Where it becomes necessary to grind the pins away entirely, the difficulty of sustaining the *veneer* in its relation to the cap during the application and fusing of the "body" is, of course, increased, and extreme care is necessary in heating the case, because of the possible expansion incident to too rapid heating; and in fusing, because of the shrinkage, each of which may result in a displacement.

This procedure may be facilitated by first covering the cap with a thin layer of "body" and fusing it until the particles are well coalesced, without presenting a glazed surface. This then admits of a more ready and secure attachment of the veneer to the cap by holding it in place and packing thinly mixed body into the space between it and the cap, until it is retained in position by the adhesive properties of the body after the moisture has been evaporated, when it is ready for the final attachment to be obtained by the fusion of the porcelain. Fig. 192, E, illustrates the finished crown.

Variation of Method.

A method of veneering platinum and gold crowns constructed in the ordinary manner, excepting that the dimensions are reduced enough to admit of

the presence of a covering of porcelain, which is retained in contact with the metal by roughening the surface, is recommended by Dr. George Evans and others, as a means of securing the presentation of a more esthetic effect, combined with the advantages of a metal crown.

As *thin* layers of porcelain, whether of the high or low fusing variety, *do not possess strength,* and as *there is no physical or molecular* (?) *union between porcelain and platinum, or gold,* the method is not considered to be a safe or reliable one.

Where the jacket crown is to be employed in combination with porcelain, the strength of the body itself, and the integrity of the attachment between it and the metal parts, both of which are essential to the durability of the finished crown, will increase in proportion to the diminution of the root, the quantity of porcelain thus accommodated, and the degree of *mechanical* attachment for it, which is to be obtained by roughening and serrating all surfaces of the metal which are to be covered with the "body."

On the other hand, it must, of course, be remembered that the degree of integrity in the attachment of the finished crown to the root will increase in proportion to the extent of tooth structure which is allowed to remain and which may be telescoped by the cap.

Use of the Davis and Logan Crowns.

Ready-made porcelain crowns, such as the Davis and Logan designs, may sometimes be employed to good advantage in porcelain work for the six anterior teeth, by combining them with a a platinum *plate* or *cap,* as a means of securing accuracy in their adaptation and permanency in their attachment to the root.

Advantages.

The advantages to be obtained in the use of these crowns in this work lie in their artistic form, their unexcelled strength, and the greater degree of translucency which the finished crown will possess, as a result of the absence of an additional layer of either metal or porcelain placed on the back of the original crown.

While their artistic shape is not to be disputed, the experienced porcelain worker, with a knowledge of tooth-form, will have no difficulty in building the body to an equally artistic outline, where a *facing* is used, so this feature is to be seriously regarded as a consideration only as a means of doing without the knowledge, and avoiding the small amount of time and work thus involved.

The inherent strength of the porcelain of which these crowns are made, which is obtained from the high fusing character of the "body,"

and from its then being properly *packed* and *fused,* is doubtless greater than the strength of the porcelain part of a crown constructed with a facing. Hence, this feature must be regarded in the light of an advantage of importance, and yet, where a simple facing is used, sufficient strength may ordinarily be obtained by *securely* attaching it to the cap, using a high-grade "body," and properly packing and fusing it.

The greater degree of translucency is indisputably true, and constitutes an advantage of inestimable value in many cases, particularly where the color is extremely difficult to match. While the texture of an ordinary facing may be practically the same as that of these crowns, and it may primarily possess the same degree of translucency, yet this important feature *is,* nevertheless, destroyed to some extent even by the presence of a backing of porcelain, of nearly, if not quite, the same color. This is due to the dividing line between, and the difference in the density of, the two bodies.

These features of *strength* and *translucency* are so important as to indicate the practicability and warrant the use of these crowns in many cases, perhaps, in preference to any other style of construction, where a good selection may be obtained.

Disadvantages.

The principal disadvantages lie in the fact that one is confined to a more or less limited selection, and that the opportunities are greater for securing a better choice of facings than of crowns because of the latter being limited to a few dozen moulds, as compared with the several hundred in which the facings are made; also the more intricate procedure, and greater length of time consumed, in grinding the crown to a proper adjustment and relation as compared with the facing.

Application of the Davis Crown.

Because of the greater facility with which a crown with a separate dowel may be adapted to the root, the Davis crown will be found more generally useful and applicable in this style of construction.

The accompanying dowel, however, is useless, and must be replaced with one of platino-iridium, because the so-called German silver alloys will scarcely withstand the degree of heat necessary to subsequently fuse the porcelain, and the latter will not become attached, or even fuse down close, to these alloys.

With Band.

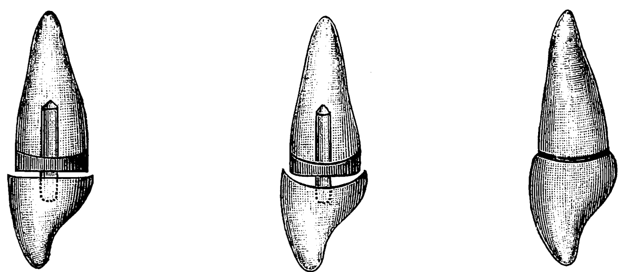
In the application of this style of crown with a band, the root should be prepared, the cap made, the dowel attached, and the impression taken, in exact accordance with the requirements indicated for the "band and dowel" style of construction with porcelain, at the beginning of this chapter.

When the model has been secured, the cap should be detached therefrom, then replaced, and the crown selected.

The surplus end of the dowel should now be cut away until only enough remains as will be accommodated by the depth of the countersunk cavity in the crown, and the latter should be ground to the proper and required adaptation with the cap and the adjacent and occluding teeth.

In this procedure the approximal sides should be ground so as to admit of the overlapping of the labial and lingual edge of the crown upon the cap. (Fig. 193, A.) This is essential for the purpose of bringing the edges of the crown into close proximity with the gum and of retaining the porcelain which is to be subsequently applied to cover the band.

Owing to the shrinkage of porcelain, it is impossible to get enough body between the crown and cap in the first or *primary* "bake" to completely fill the space. This would result in an element of weakness, of course, in the finished crown, and may be overcome by further grinding away the approximal surfaces of the crown, so as to afford opportunity for the admission of a second application of "body," which may fill all crevices caused by the shrinkage of the first. (Fig. 193, B.)



a b c

Fig. 193.

When the grinding of the crown has thus been completed, it should be attached to the cap by filling the countersunk cavity in its body with thin, well mixed porcelain, and then gently forcing it to place while on the model. The latter should now be gently tapped with an instrument several times to *pack* the porcelain *densely* around the dowel, and in the space, and it should then be allowed to dry until all of the moisture is thoroughly evaporated.

The crown should now be gently removed from the model, adjusted to a proper support, and given the *primary* "bake," and subsequently the *final* one, in accordance with the requirements which will be considered later. The completed crown is illustrated in Fig. 193, C.

Without Band. When it is desirable to construct the crown by this method *without a band,* the foregoing detail is *identical with the requirements,* after the "plate and dowel" have been properly adapted to the root and the impression taken

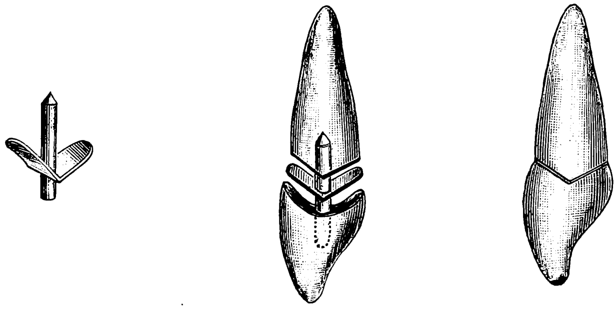


Fig. 194.

and model secured, which procedure has been previously considered in its special application to porcelain work in this chapter. The various steps in this style of construction are illustrated in Fig. 194.

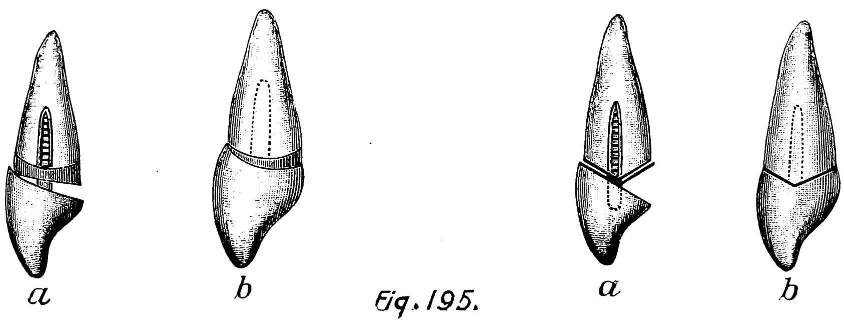


Fig. 195.

Application of the Logan Crown. The Logan crown may be used in similar manner, with either a band or simple plate, and the difference in the procedure incident to its employment lies in the absence of any necessity for using other than the original dowel, which is of platinum and which constitutes an inseparable part of the crown.

The presence of an inseparable dowel in this connection, however, adds somewhat to the detail involved in grinding the crown to the required adaptation with the cap or plate, and necessitates subjecting the porcelain

to the heat of soldering in attaching it thereto, which, of course, is not true in the use of the Davis crown.

Procedure.

In the application of this crown in combination with porcelain and a platinum cap or plate, the same detail as indicated in connection with the use of gold should be observed.

The base should be constructed of platinum of the same gauge as for the Davis crown, and the temporary dowel should be adjusted, the impression taken, and the model secured in accordance with the detail previously outlined in the consideration of this style of crown in combination with gold.

The crown should be then selected, ground as thus indicated (Fig. 195, A), attached to the base with a minute quantity of adhesive wax, removed from the model, invested, and the relation between the base and

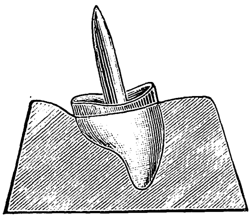


Fig. 196.

dowel permanently sustained with a small quantity of pure gold, to preclude any possible change which might result from the shrinkage of porcelain.

The soldering may be done with greater facility by covering the entire crown with investment material, leaving only the surface of the base, which comes in contact with the root and the dowel, exposed. (Fig. 196.) Considerable care must be exercised in this procedure, however, to prevent fracturing the porcelain, which can only be avoided by *thoroughly heating* the latter before attempting to solder. This space between base and crown may then be filled with porcelain "body" and fused, and the finished crown is illustrated in Fig. 195, B.

(To be continued.)

A New and Efficient Mode of Treating Aluminum in Prosthetic Dentistry.

By Dr. William D. Allen, Huntsville, Ala.

When aluminum found its way into the dental laboratory, the best quality contained a large percentage of impurity present in the barite. Besides this imperfection, silver, copper, bismuth and antimony *ad libitum* was employed to overcome the great contraction and to facilitate the flow in casting, resulting in so disturbing the nice adjustment of the molecules as to leave the casting worthless in the extreme. With a scientific knowledge of the treatment of aluminum as applied to dental prosthetics, the refined stage it has reached will enable us to make this abundant and beautiful product of nature a blessing to our patients. I therefore submit my process of treating aluminum.

Impressions are taken as for other dentures, only when plaster of paris is employed fine salt should be added, thereby making the plaster rotten after setting, that it may be easily removed from the model. The air chamber, so called, should be cut when desired, and the impression well varnished and soaped. Then prepare bolted silica two parts and strong plaster of paris one part, thoroughly mixed with water, until the mixture is a little thicker than when all plaster is used for model, which may be now run. A base plate of paraffin and wax is fashioned to model, carrying a strip of paraffin and wax around the ridge in such a way as to encircle the teeth when set. This lends additional strength and provides for a nice joint with the rubber attachment.

Investment. The piece is ready for investment in the flask. Water, silica and plaster, as above described, is used. The model should be placed in the investment the same as for rubber work. While the silica and plaster is in a soft state, a rubber tube 3/16 of an inch in thickness with a lead wire in it, so bent as to pass from the opening in bottom of crucible, Fig. 1a, along between the base plate and rim of flask, around a little beyond the median line, sunk half its thickness in the investment. When the investment sets, as many gates as desired can be cut from rubber tubing to base plate, thus forming conduits through which the molten metal flows from crucible to mold. The model is placed far enough in the direction of the bottom of flask, when standing on its legs, Fig. 1b, to admit of what I term a surplus. Fig. 1c. This surplus is merely an extension of the base plate up to the top of flask, being the same width as the base plate at the heels, Fig. 1d, and joined to it. This surplus should be much thicker than the

base plate and fully an inch or more in height, exposed at the top of the two parts of flask when assembled.

The investment in bottom half of flask having set and the surplus to base plate added as above stated, the exposed surface of investment should be well coated with liquid silex, and when dry soaped. The upper half of flask with investment is now ready to be added. Place some investment over the base plate and surplus, shaking it to make the silica and plaster settle down and remove any air. Then place a sufficient quantity in the upper part of flask and press the two halves together,

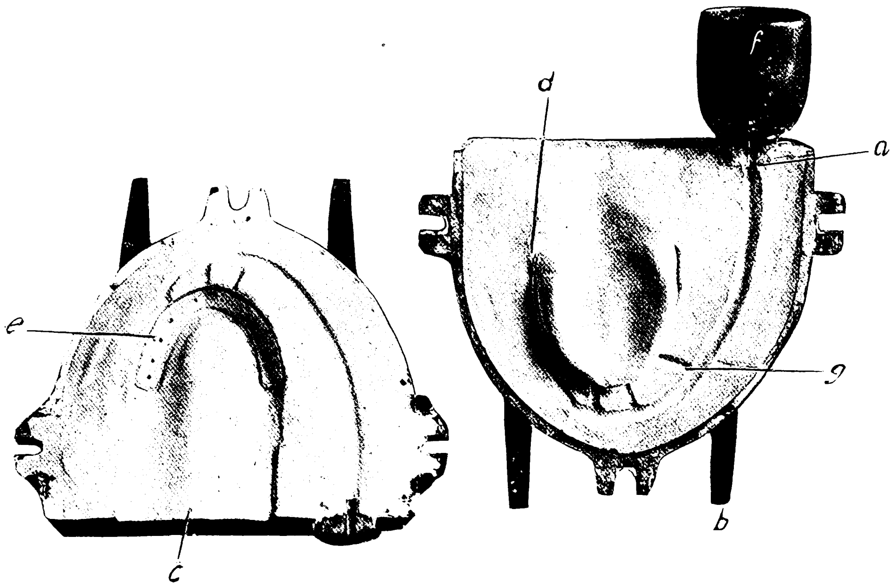


Fig. 1.

bolting them firmly. The investment in both halves of flask and the surplus or extension of base plate should be even with the open top of flask. After the last added investment has hardened, the flask should be placed on the furnace and one or two upper planes of burners ignited to warm it, by alternately exposing each half of flask to the effect of the flames until the base plate with surplus is sufficiently soft to admit of separating the flask without fracturing the investment. The next step is to remove the rubber tubing. Cut from the upper half, the impression the gates have made and wash every vestige of paraffin and wax out with boiling water. Should there be any defect because of confined air, repair with the silica and plaster. With the engine and a drill of proper size make as many

holes, Fig. 1e, as desired for pins along the ridge to hold the rubber attachment. The halves of flask are then placed on the furnace, with the investment up, and with a slow heat all moisture dried out. The two parts of flask are allowed to cool enough to handle; then every particle of foreign substance should be blown out, leaving the mold clean.

The flask is once more assembled, bolted and a ventilator of steel cloth 70 mesh is cut about three-quarters of an inch wide, long enough to cover the opening at the top of flask. This ventilator is now placed over the opening, and eight or ten ribbon pins, one-half inch in length at intervals, are pushed through the mesh into the investment to hold the ventilator firmly in place. Pins of greater length should be forced about two-thirds of their length into the investment about the ventilator to hold the luting, long asbestos fibre two parts and plaster of paris one part. This luting, while wet and soft, should be packed over the border of ventilator and among the long pins covering the exposed investment at the top of flask. This luting prevents the escape of metal when the cast is being made.

Casting. The flask is now placed in the furnace and the planes of burners are allowed to play around it until the ingot in the crucible, Fig. 1f, at the top of the flask is molten. The air compressor is placed over the crucible, and pressure, about three pounds to the square inch, is brought to bear, thus driving the molten aluminum through the conduits, Fig. 1g, to every part of the mold. With a pair of sharp, pointed tongs, hot, the ventilator is cut to admit the air, as the contraction takes place below. The heat is withdrawn first from the base and gradually on up until the top is reached.

In placing the model for a lower plate in the investment, each heel has a surplus extending to the top of flask, and each surplus should be covered with a ventilator as above described.

This mixture of silica and plaster has the rare virtue of not cracking or shrinking in the least under high heat, and is free from those gases that produce blow holes and other imperfections; the contraction of metal being perfectly controlled by this process, the casting is an exact reproduction of impression.

Polishing. Plunging these castings into a cold bath while in the flask and very hot seems to greatly improve the texture of the metal. The casting should be allowed to chill in the bath before removal, then the gates and surplus are sawed from the plate and the file used where desired. With very coarse sandpaper cut in strips, one end held in a slot cut in mandrel and the strip wound around the mandrel, the plate in a few minutes is made ready for the finer grades of emery paper; then with pumice stone a fine,

smooth surface is obtained. The final finish is accomplished with alumina moistened with machine oil, used on a buff free from grit. The pumice and alumnia should not be applied until after the vulcanization. Every exposed part of the aluminum plate must be coated with liquid silex and allowed to dry before invested in plaster, since this prevents oxidation, caused by the presence of sulphur in the plaster.

The Furnace.

The furnace for carrying out this process is very simple, consisting of a number of planes of burners encircling the flask with supply pipes, Fig. 2a, leading into each plane, each supply pipe having a cock, Fig. 2b,

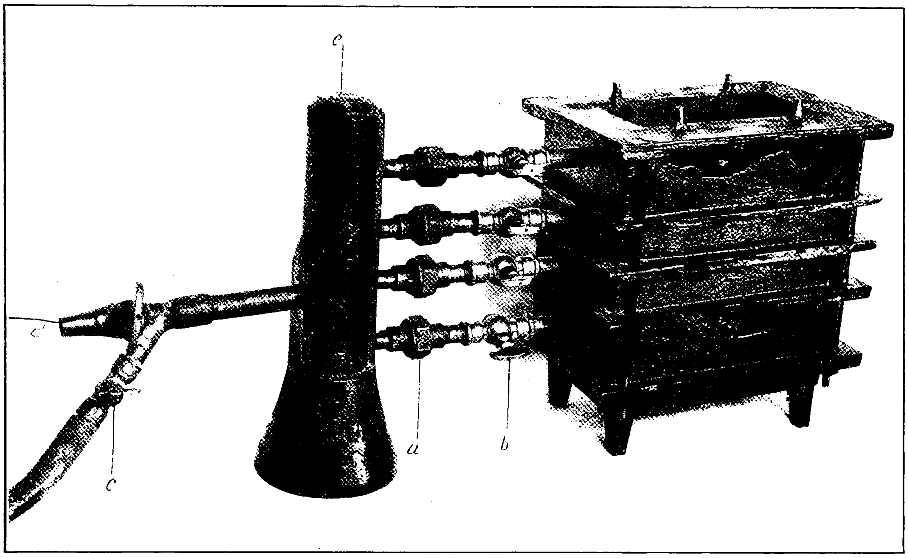


Fig. 2.

whereby the heating fluid or gas may be cut off after the molten aluminum has been forced to every part of the mold, commencing at the bottom and withdrawing the heat gradually until the top is reached. Air is admitted through a pipe, Fig. 2c, which connects with gas pipe, Fig. 2d, just before it passes into the mixer, Fig, 2e, from which the supply pipes lead to the planes of burners. This air is to produce perfect combustion, creating the blue flame which intensifies the heat. The withdrawal of the heat as above indicated is based upon scientific principles, the metal being held in a molten state in upper part of mold, in obeying the law of gravitation falls as the cooling proceeds below, bringing about the happy result mentioned earlier in this paper.

In my practice I have observed that when the metal used was in its

most refined state, a denture was produced of the highest excellence in every particular. Aluminum possesses very many desirable qualities that should be present in a dental plate, such as low specific gravity, pleasing lustre, freedom from tarnish, under intelligent treatment easy adaptation to the parts, conductivity of thermal changes in the oral cavity and ability to resist the secretions.

Bridge Work Without Mutilating the Supporting Teeth.

By Dr. H. J. MOORE, Frankfort-on-Main, Germany.

The idea in this suggestion is to so construct bands or crowns for supporting bridges that they will fit just as snugly around the necks of the teeth as around their bulbous portion. The mode of construction is suitable for cuspids as well as bicuspids and molars and even perhaps front teeth, but of this I cannot be certain.

The essential part of this band as differing from an ordinary band, is a wedge of metal in three or more pieces, having a hole drilled through its length into which a thin wire can pass, and a metal dovetail that clamps the three pieces together and which is soldered to the central portion of the bridge. These parts of the band I find necessary to have made by a jeweler, who has the machines to make them so that they fit perfectly.

A model must be made in plaster of each tooth that is to be banded, posterior tooth by itself, anterior tooth by itself, and the models must show a perfect form of the neck as well as of the bulbous portion. Small mouth trays are sold by the dealers that enable this to be done easily.

The band must be struck up in two halves, buccal and lingual; the buccal side, or half, of the tooth must be reproduced in Babbitt's metal, or fusible metal, and that half struck up, and the same with the lingual. It is, of course, necessary to bring the gold somewhat over the grinding surface as in ordinary bridge work, to prevent the bands being forced down on to the gum. The joints must be perfect.

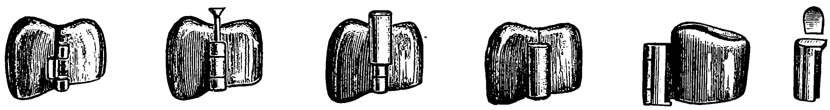
The wedges must be attached to the halves of the band, one on one side and two on the other, like a hinge. In doing this, allowance must be made for the small size of the neck of the tooth, as compared with the bulbous portion, and also as the metal dovetails are to slide into place supporting and soldered to the central part of the bridge, they must be parallel with each other, that is, the one on the posterior tooth must be parallel with the one on the anterior tooth. The easiest way is to solder the wedges on to a piece of thick gold plate. They must be accurately

soldered so that the one fits perfectly into the space between the two and so that the metal dovetail will go over them exactly. The gold plate is now filed away to allow for the bulbous portion of the tooth, and one piece supporting the one wedge is soldered to one-half of the band and the other supporting the two wedges to the other half of the band.

The thin wire is put into the hole of the three wedges connecting them and the two halves of the band together and the joint of the band on the side opposite the wedges is soldered together.

This completes the band which has only to be sprung apart in putting it over the bulbous part of the tooth, when it will be found to fit all parts of the tooth perfectly when the wedges are held together by the wire and clamped by the dovetail.

The work of construction for a cuspid or bicuspid band is exactly the same, and the canine or bicuspid band can be a window band with the certainty that the narrow neck portion will fit the tooth perfectly.



1 2 3 4 5

Fig. 1.—Band open for slipping over bulbous part of tooth.
Fig. 2.—Band closed and held so by thin gold wire.
Fig. 3.—Band closed and metal dovetail being put in place.
Fig. 4.—Band closed and metal dovetail in place.
Fig. 5.—Side view of band with metal dovetail in place.

Of course, as in all bridge work, the articulation must be taken into account. The two bands are placed in the mouth with the dovetails in position and a plaster model made. Before this is done, I should have said that it is necessary to close the top of the dovetail with a piece of thick gold plate and also to solder a thin piece of gold plate to the wire point in order to be able to remove it from the hole in the wedges. The model taken, the bands are removed and placed in the impression and plaster poured in, separated and bite arranged. The teeth are set up and soldered to the two dovetails. The bridge is now in three pieces, two bands and teeth carrying the dovetails. The bands are attached to the supporting teeth with chloro-percha or cement and the small thin wire inserted and then the center part of the bridge is cemented into place. If chloro-percha is used for this it can easily be removed for repairing or for filling, etc.

If a tooth stands in the middle of a bridge, it can have wedges and dovetails on both sides instead of having one joint soldered. With a

short tooth one portion of the wedge can be left out and the two halves of the band just caught with solder at the bulbous portion, and only the two lower portions of the wedge used.

The idea will also very likely prove serviceable in regulation devices as bands made in this manner and cemented on will not loosen easily and the dovetails could carry wires soldered to them for retaining or regulating purposes.

The band material ought to be 22 karat as usual and twenty-nine or thirty thickness. The dovetail at least twenty-seven thickness and can be 22 karat or even 18. The wedges must be as small as possible to leave enough room for the other work, but there is no great difficulty about this.

I should suggest, if the idea proves as good as I hope it will, that the dental depots make and keep a stock of the wedges, pins and dovetails ready mounted on the gold plate so that they only need to be soldered to the two halves of the bands which would simplify the work immensely.

The Deformities of the Superior Maxilla from the Standpoint of the Rhinologist.

By C. H. Kohler, M.D., Minneapolis.

In the volumes of literature which have appeared from time to time on this subject, hereditary influences and degeneracy have been given much prominence. However, despite all that has been written I doubt that the exact bearing which heredity has upon these deformities, is as clear and explicit as it should be for a thorough comprehension of the subject. It shall be my purpose, therefore, to consider briefly the condition in its entirety from the remotest hereditary physical and psychic causes throughout the successive stages to the ultimate effect.

Heredity.

The term heredity is applied to that natural law of living organisms whereby their characters, qualities and tendencies are transmitted to their offspring throughout successive generations. The tendencies are of two distinct types, one affecting merely the functional relations of the organism, while in the other there result actual tissue changes.

In a general sense man, like other distinct species, is much the same as his fellow creatures, yet each individual differs in some respect from every other member of his species who now exists, or ever has existed, or it may be assumed ever will exist. No matter how much two individuals may appear to be alike, even when seen in the wonderfully striking likenesses, such as may exist in twins, yet, when this resemblance is so strong that they can only with difficulty be told apart, there is a fundamental difference of nature which nothing can change or eradicate. Association, education and environment may and does have a marked effect

upon these types of strong personal resemblance, yet fundamentally there are radical differences of mind and matter which nothing can change.

Each is under the dominion of the natural law of evolution of his antecedents, of which he is the consequent, and thus there is a destiny made for man by his ancestors, which no one can elude.

The power of hereditary influences to determine an individual's nature has been known to all ages. In every age and country in which science has flourished there have been men who have devoted their lives to a study of this subject, and have felt that their hard-earned results could scarcely be called a beginning. So vast is the field, so many are the phenomena, that the province of natural science is practically infinite, for each animal and each plant presents special problems which open in endless vistas before the student. Theories in explanation of heredity have been advanced from the earliest times, and scientists have differed widely in their views, but, up to the present time, nothing of a perfectly satisfactory nature has been given to the world.

About 400 years B. C., during the life of Hippocrates, generally styled the Father of Medicine, Democritus offered a theory that all parts of the body contribute to the "seed," and as a result the offspring was similar to the parent. More than 2,000 years later in the eighteenth century, Bonnet and Haller advanced the "Preformation Theory." During the latter half of the nineteenth century Spencer gave us his theory of "Physiological Units," Darwin his of "Pangenesis," and Prof. Aug. Weissman, the theory of germ-cells or germ-plasm. And, while more than 2,000 years have elapsed between the first and last three named, the latter are probably as far from right as that of the *confrere* of Hippocrates, for they all ignore one or more of the essential conditions necessary for a perfect explanation.

While we have no present day theory which can be called a theory, *per se,* we have nevertheless reached some well-defined conclusions which differ radically from any theory ever formulated.

In considering the subject of heredity, it is necessary in order to proceed lucidly and logically to discuss the inherited tendencies from the standpoint of health or the *normal,* and of disease or the *abnormal.*

Normal Inherited Tendencies.

It is hardly desirable here to take up much time in considering the normal inherited tendencies, for the subject which I discuss here today has to do entirely with the abnormal. However, to emphasize the importance of giving due weight to hereditary influences, I recall to your mind a few of nature's strongest characteristics in the evolution of mankind. Of first importance are the extrinsic conditions of environment, education, habit, parental influence, etc.,

which govern the life of the individual or being, and are the dominating factors in the mental and physical evolution.

Man, like every other distinct species of animal, originated probably from a common stock and the races and nationalities are merely deviations from the original because of the conditions previously mentioned. What is merely an acquired habit in the parent may become instinct in his progeny. "Habit," it is said, in us "becomes second nature;" it can be as truthfully said that in our children it may easily become *first* nature. Each of us by a certain mode of life, education and environment has become a modification of the original type.

The well-bred bloodhound or the "pointer," or any of the standard-bred dogs of distinct and peculiar characteristics, was probably in remote ages just plain dog, like its degenerate brother the common yellow cur, proverbially the most useless of useless specimens. I wish to convey to you in other words that they have inherited with constantly increasing tendency the predisposition of their progenitors, just as the child inherits a predisposition to some strong mental or physical characteristic of its ancestors.

All these things, however, are so familiar to you that I shall not dwell on them further, and have recalled them to your mind mainly to emphasize the powerful influence of heredity and the necessity, therefore, for a comprehensive knowledge thereof in the conditions which I shall now consider under the other heading, the abnormal or diseased types, which lead to the subject proper of this paper.

Abnormal Inherited Tendencies.

In considering the abnormal type we say that deviations from the normal are due to influences, extrinsic and intrinsic, affecting function, which in turn affect structure. The changed functions and structures thus inherited become integrated throughout successive generations, and create, modify or obliterate physical and mental characteristics.

We consider disease hereditary in two distinct forms; 1st, where the inherited condition exists in a weakened vitality, or lack of normal resistance in some tissue, and which we speak of as a *predisposition.* Here the *functional* activity of a tissue or organ is mainly at fault and is more vulnerable to diseased change or infection. 2d, where there is a direct transmission of an organically defective tissue or organ.

This distinction will do for practical purposes and we may thus consider inherited diseases under these two heads. To be absolutely accurate, however, this could not be done, owing to the lack of an exact knowledge of heredity as heretofore spoken of, and also to conditions where both causes seem so thoroughly intermingled that we cannot say that they belong essentially to either class. I can best illustrate the types referred

to by naming a few diseases belonging to each class. In the first class, tuberculosis, gout, rheumatism, cancer, hysteria, etc., are the diseases in which only a *predisposition* is inherited, this predisposition being a tissue of lessened vitality, lacking in the power of resistance to the invasion of disease or germs, lying latent, and in a sense, harmless, but a fertile soil for radical change under the proper provocation. Until a few years ago it was considered that consumption was directly inherited; that a poison, or diseased cells, were directly transmitted from parent to offspring and remained latent or inactive until the vital forces were in some way weakened, when they suddenly developed into the disease proper. Now, we know that this is not correct, but that a specific germ, the bacillus of Koch is necessary, with the proper tissue soil, for its development.

A case in point is one I saw reported recently. A family of seven children had a tuberculous father and mother. The second and fifth child never lived with the family, and not alone showed no symptoms whatever of consumption, but had healthy children of their own. The other five children under the same roof with the father and mother, and therefore in an infected atmosphere, all died of the disease. There are numerous other instances of individuals of tuberculous parentage passing through life without any sign when removed from the source of infection.

In the second class we have syphilis, physical deformities of the teeth, hare-lip, club-foot, cleft palate, etc., errors of vision, like near-sight (due to an elongated eye-ball), a number of skin diseases, etc., all of which are directly transmitted and in which there is organic change in certain tissues. Syphilis differs from the rest in that a poison is probably transmitted through the blood. In some cases we have a complication of the diseases named in the first and second classes, or diseases which belong to both classes, rather than to either, such as asthma, hay-fever, etc. In asthma and hay-fever we have the functional and the organic condition combined.

Influences of Environment.

Individuals with acquired degenerate conditions are capable of transmitting to their offspring a predisposition to such degenerations. Bad hygienic conditions, as filth, poverty, starvation, overwork in ill-ventilated rooms, want of pure and wholesome food, are important factors in producing degeneration. The acquired ailment of the parent becomes the inborn infirmity of the offspring. As an illustration let us imagine twin brothers who have entered the world as like as possible. Send one of these infants to a farm home to be brought up and let the other be reared in the slums of a city, in the midst of poverty and vice, and what will be the result? The one who breathes the pure air, feeds

on plain but wholesome food, does an honest day's work every day, will reach manhood full of health and strength, while his brother, bred in the slums seldom, if ever, breathing the pure air and fed on food wanting in many of the essential constituents of wholesome diet, will arrive at manhood, should he reach that age, a physical degenerate, no more like his twin-brother in the country than Hamlet was like Hercules. Here we see the effects of environment upon the physical life, and no more proof is needed to make clear the fact that its effect upon the mental and moral nature is equally powerful. As the physical health can be developed and preserved only by good habits, nutritious food, pure air and exercise, so the mental faculties can be enlarged and brightened only by education and *example*. Hence, "Heredity and environment are masterpieces of the organic world; they have made all of us what we are."

Fortunately, Nature makes a wise provision in her tendency to "throw back" or revert to the *normal*. If, for instance, one parent be perfectly healthy and from a healthy family, while the other parent is unhealthy and from a degenerate stock, a reversion to the healthy will, in all probability occur in some of the children at least. On the other hand, if both of the parents are degenerates of the same or different varieties of degeneration and from degenerate families, their offspring must necessarily retain their parents' peculiar characters, and when these characters become extreme, the stock dies out and the family becomes extinct—an example of the "survival of the fittest."

Now you may ask how this particularly concerns the title subject which I am here to discuss, and I answer, in a word, that it shows us the constitutional conditions which, in my opinion, have so marked an effect on maxillary deformities, and as well makes plain that these causes must be considered in order to properly treat so many of the deformities which come to us for help.

To make the advance which is possible for a progressive profession every dentist who aspires to be in the *progressive* class must learn that he is not limited in doing good by mechanics and mechanical ingenuity. An esteemed colleague for illustration, in a book published within the past year devotes four hundred pages to causes wholly theoretical and two hundred pages to treatment, *all* of a mechanical nature, *and a half a dozen lines to the treatment necessary for conditions which are responsible for* 50 *per cent of the irregularities*. What seems so strangely inconsistent in the aforesaid colleague, is that he should devote four hundred pages and even whole books to constitutional causes and then after telling us all about the baneful effects, to pass by absolutely anything which would correct these causes and, ignoring them entirely, write page after page on mechanical correction of the irregular or deformed teeth.

Influence of Disease on Deformities.

I shall now take up a consideration of the diseases, and give you my idea of the way in which they affect maxillary deformities. Of practical interest are all congenital nervous diseases, tuberculosis, syphilis, gout, chronic alcoholism, idiocy and imbecility. These diseases and the inherited tendencies thereto we call the indirect causes of maxillary deformities.

A child with parents, or even remote ancestors, suffering from one or more of these diseases, begins life even before birth, in fact, from the time of its conception, under adverse conditions; certain tissues are, at the very beginning, below the normal in vitality and natural resistance. As a result they are either born as before stated with a *predisposition* to invasion of disease, or with the disease itself already a part of their constitution.

The child in utero, in its embryonic state, develops with certain tissue of an inferior quality which does not attain full structural and functional perfection. We know it to be a physiological fact that this is true and that tissue in one organ can come to full structural and functional perfection while other tissue or organs in the same body remain undeveloped. This tissue we speak of as abnormally non-resistive to disease, because it has not attained its maturity or has undergone a temporary or permanent retrogression. Where this predisposition exists at birth or develops later there is a very strong tendency to cell-proliferation in much of the tissues of the lower type. For instance, fatty and connective tissue are of this type and the cell and fibre of these tissues may be organically perfect at birth but in cases where an inherited weakness exists these tissues show the greatest tendency of any tissue to cell-proliferation. It is this type of tissue which constitutes the diseased conditions which I contend are such important factors in the faulty development of the maxillary bone.

The diseased conditions which we speak of as adenoids and enlarged tonsils, or hypertrophy of the tissue in the nose, are made up entirely of this inferior quality of tissue and oftentimes at the expense of tissue of a higher quality. Thus you see that cell-proliferation and the consequent enlargement of the tissue is due to two causes; first, the general or constitutional weakness, where the tissues in general are lessened in vitality, awaiting only an exciting cause; and second, because *the lower type of tissue attains maturity first and develops excessively under the slightest cause.* Provocation for the development of diseased conditions in the nose comes very early to a surprisingly great extent as we shall see later, when we consider these topics under the head of direct causes. The higher type of tissues, like the brain cortex develops much more

slowly and is the last to attain maturity and perfection and for this reason has comparatively little to do with the early development of the troubles of which we speak. Sometimes this lower tissue takes the place of a higher grade or the higher qualities suffer retrogression and then we have other conditions manifested. For instance, if some vital spot in the brain is affected we have some defect in the special senses, or if the diseased condition is general throughout the brain, we have imbecility. If the spinal cord be affected we have a faulty development of some part of the body, or a lack of coördination, and some spinal disease becomes manifest. If the defect be of a general nature, affecting more or less all the tissues of the body, idiocy is the result; or, if the tendency be less marked we have what we generally understand by the term scrofula, or a gouty or syphilitic or other diathesis, or possibly only a lymphatic temperament. But whether it be of a slight or great degree, the *quality* of the tissue is at fault, and wherever the quality of the tissue is below the normal, the tendency for the development of adenoids, enlarged tonsils, polyps and other hypertrophies of the nose is increased. This means that where you find the constitutional defect, you find coexisting the abnormal tissues in the nose or naso-pharynx, which cause defective breathing, and these conditions are apparent for months and even years before you find any change in the upper jaw of an abnormal nature. Among the commonest affections all over the world, among healthy and unhealthy alike, are troubles of the nose and throat, the most common of which is the condition we speak of as "cold." Everybody practically from infancy suffers at more or less frequent intervals from simple coryza, mainly for the reason that this is nature's method of throwing off the disturbed relations of the body from the process which we undergo when we have "taken cold." Two conditions particularly predispose us to colds; a general depression of the system or a decreased vitality of the nasal membranes. This fact is so generally known that it requires no proof or elaboration, and if you will grant this you will see why children with the inherited local and general weaknesses of which I have spoken, must of necessity suffer frequently from cold and that the cold is the necessary local irritant for the cell-proliferation of the defective tissue in the nose and throat. The general and local conditions are fertile soil for the development of nasal obstruction upon the slightest provocation and when every child suffers from that provocation it is not hard to understand why nasal conditions are so important a factor in maxillary deformity. In what I have said so far, I have tried to cover the predisposing causes which, in the table herewith presented are under the three heads, climate, hygiene and constitutional weaknesses, these being the *indirect* causes which are responsible for what I have termed the direct causes; namely

adenoids, enlarged tonsils and nasal hypertrophy. There is still another class of diseased conditions which, with the last three named should come under the head of direct causes; namely, the septum and its diseases. Deviations of the nasal septum are just as important as the other conditions named, because, like the other trouble the disturbance comes from infancy or early childhood.

Deviations of the Nasal Septum.

Of the three causes mentioned above, adenoids and deviation of the septum are of the greatest importance, and it is my opinion that the majority of the severest forms of constricted vault have their primary origin in the deviations of the septum. This condition begins very early in life, and generally results from falls on the nose. As soon as children are able to crawl or walk, more or less severe bumps on the nose are of frequent occurrence. If a blow is of sufficient force, some part of the cartilage is likely to yield by deviating to one or the other side, and the growth of the child develops this deviation in its unnatural lines.

If this proves to be a marked deviation, trouble arises from two sources; first, from its tendency to develop hypertrophic tissue in the nose, or adenoids in the naso-pharynx, or if the amount of deviation be sufficient to limit greatly the space in one or both sides of the nose, the breathing becomes defective from these perverted influences; and, secondly, the hard palate loses its natural support from above, and when the mouth-breathing begins we have necessarily the dropping of the lower jaw, the pressure of the cheeks on the alveoli, displacement of the tongue, elevation and retraction of the upper lip, *and the perverted influence of the muscles of mastication.* Thus the constriction of the upper jaw begins and goes on, till the eruption of the permanent teeth with insufficient room in the unnaturally small space allotted to them, which, by their pressure, aid in causing the different varieties of constricted vault, and to some extent the irregularities.

Adenoids, Enlarged Tonsils, Hypertrophies.

We consider adenoids, enlarged tonsils and nasal hypertrophies as one, because they all cause trouble in the same way, by obstructing the normal air passages, thus making mouth-breathing imperative, differing only from the second class in that the hard palate has its normal support from the septum.

The indirect or constitutional causes are of importance only so far as they bring about the conditions just enumerated under the head of direct causes. In other words, if, for instance a child is born with a strumous or syphilitic diathesis, or is idiotic, certain tissues as a result develop excessively. The tonsils enlarge and adenoids or hypertrophy in the nose

develop, because this very tissue, being of an inferior quality, takes the place of the normal tissue, and makes the child one of lessened vitality and inherent weaknesses. The nares as a result become occluded, mouth-breathing supervenes and here we pass into the first class, or direct causes. Or, in instances of this type, where there is already slightly defective breathing in a child who has passed the age of infancy, a fall or blow on the nose of considerable force bends the still yielding tissues of the septum, and then such an accident at once throws this patient in the more serious class where the resistance of the septum is gone. These conditions arise generally previous to the tenth year, and the child who lives to this age and breathes properly, rarely has an irregularity or deformity of even a reasonably marked degree, except possibly as the result of an accident. This, in my opinion, if I can substantiate my position, is the best proof I can offer you that defective breathing precedes most decidedly any other etiological factor, except constitutional tendencies, and that the other causes, such as crowding of the teeth, are entirely secondary.

My reason for believing this I shall now endeavor to explain more fully. In certain text-books much emphasis is given constitutional causes, such as malnutrition and the inherited tendencies, these conditions being given as the direct causes of deformities owing to crowding of the teeth, which in turn it is stated cause the difficult breathing and subsequent deformity. The question arises therefore as to which is the cause and which the effect. To ascertain which position is correct it is only necessary to settle conclusively which condition comes first. As I said before, you can always find the difficult condition in breathing long before an irregularity in the teeth manifests itself, and that is why I consider constitutional conditions of importance only in so far as they cause disturbances of the nose.

In statistics carefully gathered from about fifty institutions of the deaf, dumb, blind, feeble-minded and insane asylums, located in this country and in Europe, we find that 60 per cent of the inmates have some deformity or irregularity of the upper jaw and that all have one or more of the conditions which cause defective breathing. This means simply that where any condition of degeneration exists, resulting in blindness, deafness, mutism, idiocy, etc., the very reason for this degeneracy exists in the weakened defective tissues in some spot, which in the nose or throat develops into adenoids or other nasal obstruction, producing defective breathing as a consequence. In proof of this you will find that the lower animals or the savage races have these deformities only in a very small degree, the reason being largely constitutional. In the first place their general nutrition is very much better, and in the second, they have few of the inherited tendencies to which I have referred. In any

race, no matter how enlightened or savage, where you find decided constitutional disturbances, you will find deformity of the teeth and vault, but you will also find, preceding the deformity, one or more of the three principal nasal deformities to which I have referred.

Among idiots, deformities are so common that we have a typical idiotic face, due almost entirely to the condition we find in mouth-breathing. Add to the dropping of the lower jaw and separated lips, a slight drooping of the eyelids, and we have the expression commonly called idiotic.

Another phase of this question is noted by certain nerve specialists who assert that the "V" and "saddle-shaped" vaults tend to increase or even develop a mental defect by limiting the cranial capacity. That, in other words, as the vault becomes constricted, the pressure of the vomer becomes so great that the cranial bones contiguous with it are forced higher in the cranial vault, thus constricting its contents. We have reliable cases on record in which this pressure in extremely high vaults, with a resisting septum, pushed the inferior wall of the cranium high up into the cranial vault, and so retarded the development of the brain that different forms of mental derangement resulted, differing in degree from slight forms of dementia, to cases of radically incurable insanity. Now while the extreme conditions may be seldom met with, it should teach us that if it has only a slight effect in many cases in retarding the cranial development, it is a matter of such vast importance that we cannot afford to overlook it. Probably I should state before going any further that a perfectly straight septum rarely exists and that practically everyone has some slight deviation or, if not really a deviation, a cartilaginous or osseous projection on one or both sides.

You see, therefore, that the patient suffers in two radically different ways. If the septum is straight, there is likely to be damaging pressure in the brain. If it deviates, the breathing becomes defective from causes already stated.

In this same connection I wish to speak of two other conditions having a strong bearing on this matter, these being the anatomical changes which evolution seems to be bringing about. I have noticed in your textbooks the statement by different writers that the jaws of people today appear to be much smaller than those of our ancestors. If this be true it may account for the crowding of the teeth and the irregularities in general. Another explanation for the existence of so many deflections of the septum is in the same line. The explanation I have in mind is from one of the most eminent anatomists of today, who believes that in the past our ancestors had much larger and more roomy noses. In the process of evolution, as we have become more and more civilized, the

space for the vomer and ethmoid have become less and less, while the bones themselves have remained the same. Being too large for the space allotted to them, something has had to yield, hence the deviations spoken of, or the increased pressure on the cranial bone.

It was my intention here to take up the deformities of the inferior maxilla, with special reference to its effect on deformity of the superior bone, but I understand that there are several papers to be read on malocclusion which, it is safe to assume, will cover the subject much more fully than I think advisable here.

Retarded Development. I should like, however, in passing, to call attention to the very important bearing which a retarded development of the inferior maxilla has in the cases of malocclusion. In the nasal conditions spoken of, one of the early complications is a tardy growth of the lower jaw, and when it is remembered that this lack of development affects the entire bone, you will readily see that a very slight change in size will throw the teeth out of the line of occlusion. This will be better understood by directing your attention for a moment to the changes in the bone with age. Anatomists tell us that these changes are so ordered that the gums or teeth shall meet in biting. At birth the angle is about 175°, showing only a very small curvature, so that the resemblance to the same bone in adult life at 110° is surprisingly slight. The greatest change occurs in early life. At infancy it is about 175°, at four years about 140°, and at eight about 120°, so you will see that this is the period of stress and anything that interferes with these necessary changes must have a marked effect on satisfactory occlusion. The dropping of the lower jaw in mouth-breathing from the very position the jaw assumes is, in itself, sufficient to interfere with its development. The reduction of the angle does not occur as rapidly as it should, due largely to the changed relations of the articulation. With the jaw constantly dropped the condyle assumes an unnatural position, and in a very short time occlusion is impossible. It then naturally follows that with the lower jaw in faulty position, the superior maxilla is without proper occlusion and must of necessity develop under adverse conditions. However, as before stated, it is not the province of this paper to go into the deformities of the inferior maxilla, but I desired to call your attention to the fact that the deepest investigation and closest scrutiny into the causes will, in my opinion, lead you in the end to, and can be properly accounted for by, the mouth-breathing theory.

Another condition worth consideration is the effect that ossification has on the maxilla, in these cases of perverted development. Too little attention has been given this very essential matter and I believe future research along this line will reveal much of importance on malocclusion.

Nothing in particular is said in our text-books on anatomy, on the centers of development, except possibly, that which includes the four incisors. This is the last one to become ossified to the palate process and its junction to the line of molars is the last stage in the final development. For this reason when the molar process becomes fixed the front teeth must, to a certain extent, find space as best they can so that where a narrowing of the diameter between the molars exists the room for the incisors is limited and their growth then is naturally in a forward direction. The retraction of the upper lip removes the natural pressure from the front, the muscles of mastication act with perverted pressure, and thus intensify the unnatural development. This condition absolutely never exists where defective breathing is not present.

I have made this statement many times to a number of my friends in your profession, who did not wholly agree with me, in discussing these conditions, but they have yet to show me an exception to this statement. Traced to its earliest source it is impossible to find that mouth-breathing does not precede any other direct causative factors which result in a deformity of the teeth, except those herein mentioned.

I contend therefore that mouth-breathing in its fullest sense is the most important etiological factor in maxillary deformities, and in looking for a practical solution of the problem for correcting these difficulties, among the essential considerations will be the conditions that *directly* and *indirectly* are responsible for defective breathing. As before stated, defective breathing is caused mainly by one or more of the three conditions—deflection of the nasal septum, adenoids or hypertrophic tissue in the nose. Did none of these conditions exist, it is my opinion that the dentist would rarely see a "V"-shaped or "saddle-shaped" vault, for in ten years of private practice and in the hundreds of cases I have seen in clinics, I have yet to see a faulty vault in which one or both of these conditions did not exist, and I hope to show you that this is the cause and not the effect. Adenoids frequently become apparent at birth, and I have removed large masses in children from one to two years old. It is occasionally necessary to remove enlarged tonsils as early as the first or second year, and as I have told you before, deviation of the septum often results from a fall so early in infancy that the patient, when grown up, has no recollection of any injury. *On the other hand, it is very rare to see a faulty vault under five years and generally it does not begin to show much before the eighth or ninth year.*

A positive proof of additional value in contradiction of the argument that crowding of the teeth is responsible for these deformities is the fact that there are a great many vaults *in which there is absolutely no evidence of any crowding of teeth, coexisting with V-shaped vaults and like de-*

formities. I have a large number of models here, which I can show any one interested, of the most perfect teeth, regarding position and apposition with absolutely no evidence of crowding and yet in which there is a very high V-shaped vault or other irregularity, the deformity being unquestionably due to defective breathing. Until some one can successfully controvert this statement I am going to continue to believe that it is the other fellow who is wrong. There is one exception to these conditions, in the marked irregularities of the typical variety where the teeth come at random and seem to spring from any part of the alveolar process. In some of these cases there is no evidence of defective breathing or any particular deformity of the vault. Here the constitutional taint is wholly at fault and malnutrition, arrested or perverted development, or perverted arrangement of the tooth germ, is responsible for the irregularity. In these cases the faulty inherited tendency is so very apparent that the correct etiological factor is seen at a glance.

The two particular reasons advanced in opposition to the position I take, particularly on the part of one very prolific writer who has made this subject his life-work, are crowding of the teeth, which has already been considered, and the fact made very emphatic by him, that there are no irregularities or deformities with the first set of teeth. This assumption is positively wrong as the experience and investigation of hundreds of dentists will show, but it is probably correct to say that they are infrequent. The reason for this, in my opinion, is very plain. The first and most important is that the temporary teeth are in no sense a part of the maxillary bone, as compared with the permanent teeth, and are in position long before any of the baneful effects of defective nasal conditions manifest themselves. The germs spring from tissues which are comparatively superficial and of a soft and spongy nature while the germs of the permanent teeth are high up in the process and begin to be affected in their descent. It is further true that the muscles of mastication do not become active early enough to affect the temporary teeth but become very active during the descent and eruption of the permanent teeth and here the buccinator becomes a very powerful factor, particularly in the saddle-shaped variety of deformities. It is not alone the pressure of the cheeks in the dropping of the lower jaw, in mouth-breathing, which is so harmful, but the great pressure of the muscles used in mastication which makes a slight condition a prominent one as soon as the occlusion is not absolutely perfect. This is very marked in models such as I have here where the pressure of the buccinator is so apparent that it will hardly leave anyone in doubt as to the influence it exerts.

Before going into a few conclusions, I wish to give you a brief résumé of all that I have said above, which I think is made very simple by

the following table. As will be seen, the constitutional defect, with adverse hygienic or climatic conditions are responsible for adenoids or nasal trouble as the one element, and conditions of the septum in disease as the other, result in mouth-breathing and the latter in turn causing the conditions which follow:

Malnutrition,
Lymphatic Temperament,
Blindness, Mutism, Deafness,
Neurotic Tendencies,
Strumous, Syphilitic and
other diathesis,
Imbecility,
Idiocy.

Climate. Hygiene. Constitutional Weakness,

Adenoids,
Enlarged Tonsils,
Nasal Hypertrophies.

Injury. Excessive size of vomer and ethmoid.

Deviation of septum.

MOUTH BREATHING.

Dropping of the lower jaw which is followed by retarded development of the bone, excessive pressure of the cheeks on the alveoli and elevated and retracted upper lip. Displacement of the tongue from superior maxilla. Perverted action of the muscles of mastication. Contractions of nasal fossa and upper jaw.

Typical and Atypical Deformities.

"V" or "Saddle-shaped" vault. Irregularities.

Excessive pressure on septum.

Deviation of septum or pressure on base of brain.

Necessity of Nasal Treatment.

Now if a constitutional tendency or a weakened tissue predisposes one to these nasal disturbances and these precede deformities of the vault or teeth, what can be more rational than first to do everything within our means to improve the condition of the tissue, by checking or eradicating the constitutional weakness and then, if this can or cannot be done, correct the difficulties of respiration which predispose to and precede maxillary deformities, and *lastly* resort to mechanical means necessary for the correction of the teeth?

Now, if my conclusions are wholly or even in a measure true, think of the people who are permanently injured by not having everything done within the power of the dentist, or the nose and throat or other specialist, in correcting these deformities; and not alone the physical injury, but the unsightly physiognomies resulting thereform. It seems to me therefore that a radical mistake is made when all these causes are not taken into consideration. The first mistake is made by the family physician who allows this to escape his notice long before the dentist or the nose and throat specialist has *anything* to do with the patient. But I think the dentist is at fault and does the patient possibly an irreparable injury when he considers that his work is all that is necessary and does not know, or if he does know, neglects the other conditions present, which must be corrected before an ideal result is possible. Many of our text-books, and I judge therefrom, your teachers, devote everything in the nature of treatment to mechanical means. This appears to me wrong, even from their own conclusions, because where a constitutional defect exists this must first be corrected, or at any rate improved, to attain a satisfactory result. And if my position is, in the main, correct as to the direct causative factors, they are doubly wrong to advocate a correction of the defect by treating the effect and ignoring the cause, when that cause makes your mechanical efforts practically futile, while a correction of the cause would in itself arrest the progress of the deformity and make your treatment much more simple and effective. I believe that the removal of the cause, which I deem defective breathing in its full sense, will do more for the correction of the deformity of the jaw, unaided by mechanical means, than you can do by any mechanical means unaided by a removal of what I deem the cause. But used together, we have the most certain means for obtaining the most perfect results.

A case in point is one that came to me about four years ago. One of our ablest dentists began with this patient when she was eight years of age to correct a very bad irregularity. In about a year's time he had accomplished all he thought necessary. Three years later she came back to him *with almost as much trouble as she had in the first place.* He again corrected the condition, taking nearly a year for the work. At the age of fifteen her teeth were again decidedly irregular and her father wanted her to go to the dentist again. She, however, by this time realizing that she had a very troublesome condition of the nose and throat, which made mouth-breathing imperative, rather insisted that the money and time be spent for that. She was thereupon sent to me and in about three months time I corrected the nasal condition so that she breathed properly. Immediately following the conclusion of my treatment she was sent to the dentist and her teeth again corrected. Three years have now elapsed

and her teeth are in better condition than when the dentist discharged her the last time.

It is always a matter of particular regret in presenting a paper of this kind that the time is too limited to more than touch upon many of the conditions which require extensive consideration. One cannot help but feel that even with the most persistent efforts in condensation and brevity we are likely to tax the patience of our auditors, indulgent and interested though they may be. I should like to elaborate upon the constitutional conditions, particularly in the efforts necessary to improve the conditions as we find them, but I will of necessity consider this essentially in the domain of the physician. I deem it advisable in my concluding remarks to say also that I have purposely stated my ideas and position from the standpoint of the rhinologist in its strictest sense, realizing full well that there is a great deal to be said from the standpoint of the dentist which I have not touched upon, because that is essentially your domain, and I could add nothing of interest or value to you. Until the people are educated to the point to voluntarily marry with a proper consideration for the wellbeing of their offspring, or until our laws shall successfully interfere where this is not done, so long will the unfit be begotten and immense avoidable suffering continue in the world, the "sins of the parents being visited upon the heads of their children." To the thoughtful observer it is very distressing to see educated men and women who have reached years of discretion, where good judgment should prevail, so completely and selfishly ignore the laws of heredity, but so long as these conditions prevail we will have to contend with the diseases we are here discussing and meet them as best we can. This I believe is best accomplished along the lines herein stated.

Discussion.

Dr. Angle. You have listened to the reading of two very excellent papers and I am proud of them. It seems to me one of the very promising conditions of this society is that we can meet and discuss just such problems as these which have always perplexed us as orthodontists. We can discuss matters in which we have been so far apart in the past, and the orthodontists and rhinologists can meet and discuss the questions of interest to them.

Dr. Casto was called on and replied that he would like to ask a question, and said to the essayist: In speaking of heredity, I believe you said that in specific instances, in specific diseases as in syphilis, that it was transmitted by means of the blood?

Dr. Kohler. That is not known; it is supposed to be that.

Dr. Casto. How about transmission from the father; can that take place?

Dr. Kohler. The transmission comes either direct from the father, or the mother becomes infected and then it is from her. It can come in either way.

Dr. Watson. Just a word regarding a single statement made by Dr. Kohler.

He, like many other writers, states that there is little, if any, malposition found in the deciduous teeth. That the percentage of pronounced malocclusion, in the deciduous teeth, is infinitely less than in the permanent ones, is unquestionably true, but "little if any malocclusion is found in these teeth," is a statement which, I think, is not sustained by careful observation. I have seen excessive "upper protrusion," in a child less than three years of age, and a great many cases of a milder type, especially those belonging to Class I. (Angle Classification.)

If the statements of writers of former years concerning this subject are reliable, then, either malocclusion of the deciduous teeth is becoming more common, or my experience is an unusual one.

Dr. Kohler has failed to recognize the fact that there are different forms of malposition of the teeth. We believe, I think almost to a man, that a certain type of irregularity is always preceded by nasal occlusion, by mouth-breathing, that is that type of irregularity in which we have protrusion of the upper teeth and narrowing of the arch and lack of development in the lower jaw. But that there are other types of malocclusion of the teeth which are in no wise associated with any nasal or post nasal obstruction is absolutely beyond question.

Dr. Copeland. You orthodontists form such a mutual admiration society that you are not disposed perhaps to attack the Doctor and myself. So far as I am concerned I am not used to this kind of treatment. Ordinarily when a paper is read I expect at least two-thirds of the people present to take exception to every statement made in it, and to be agreed with so fully is rather disheartening.

But I would like to hear from you gentlemen who know whether it is true or not that you always have mouth-breathing before you have irregularity of the teeth? Is it true that you have mouth-breathing in all cases of irregularities of the teeth? (Some one answered, No, not always.)

As a general proposition I do not believe that mouth-breathing is the sole cause. At least so far as the septum is concerned there are other

causes for deflection, and if I had time—I wish I had a week, because it would take that long I suppose—I would like to discuss this whole subject of heredity and degeneracy. I do not believe you orthodontists are treating a lot of degenerates. I do not believe you want that to be your business and I think there is a reasonable explanation other than that of heredity and degeneracy. I do not believe it is true that malposition of the teeth is transmitted to the offspring and there is plenty of testimony to refute that idea.

The Doctor in his paper spoke of this malformation as being very common in feebleminded people and idiots. We know that the condition of feeblemindedness or idiocy may be due to reasons physical rather than mental. There may be too early union of the sutures of the skull so that the brain cannot develop, but I do not believe there is *direct* relationship between degeneracy and the malformations under discussion. I believe there is another way to explain it and I wish you gentlemen would discuss that and certainly if you have cases of malposition of the teeth unaccompanied by mouth-breathing, patients who have never been mouth-breathers, Doctor Kohler's theory is overthrown. I believe there is a large proportion of these cases which are due to too early fusion of the basioccipital and sphenoidal bones.

I agree with the Doctor, of course, that many cases of malocclusion are undoubtedly due to mouth-breathing. But this cause alone leaves a great number of cases unexplained. What about these?

Dr. Brady. I will have something to say as the discussion has taken this form. There is about twenty-two per cent of the total number of irregularities that is due to mouth-breathing. There is some sixty per cent of the total number of cases due to another cause which has absolutely no connection with mouth-breathing in any way. (Some one asked: What is it?)

This cause is such a large one that I cannot explain it in a word or two. It is really the thing that I intended to present at this meeting, but I have not been able to get the material in proper shape to present it. I hope that at the next meeting of this society I will have it ready, and that I will be able to show a satisfactory cause for nine hundred and ninety-nine cases out of a thousand—the other one I will not attempt to account for.

And when I do account for the nine hundred and ninety-nine cases, I will put sixty per cent of them in one class, and prove that they all come from the same cause, and this cause is not even remotely connected with mouth-breathing. In mouth-breathers the arch is always of a certain definite shape, so that it is recognizable at a glance. It varies only in degree, not in form.

Tomorrow my charts will show my observations in this direction; I believe I have a point or two to offer which is new even to orthodontists that have been talking on this subject for long years.

Dr. Angle. Before passing the subject I feel like thanking Dr. Kohler personally; to think that a man should come fifteen hundred miles to read a paper on a subject in the interest of a branch of science apparently so remote from his own class of work; he is certainly entitled to respect and appreciation to a very high degree. Still I cannot agree with his statement that mouth-breathing precedes all cases of malocclusion. I think he will have to change his opinion in regard to this, yet that one statement will make us think a little closer.

I am delighted with such a carefully prepared paper. It will give us a chance to study. There was so much in it I could not follow it all. I will read it over closely when published and I will be proud that it was given before this society. I wish to thank Dr. Kohler personally.

Dr. Kohler. I would like to say that it is a matter of surprise to me to find that I have so many auditors who agree with me, for you all seem to do so in a general sense, if not willing to think as I do in all that I say. I live in a section of the country where our thought is largely dominated by a man who takes the opposite position in almost every sense, and while I have read papers on this subject before other societies at different times along the same lines, I have always been attacked almost viciously. It is a decided pleasure therefore to find that there are people in the world who look upon it from my side, and I think it is only a question of a little time when there will be more. There are too many minds at work to be very long in doubt as to the causes of these deformities and I am very sure from what I see here today that the minds coping with this subject are as capable as those which have been working on the other or contrary side of the proposition.

I would like to say that I purposely made my remarks in this paper from the standpoint of the rhinologist in its strictest sense, having made it rather partial than impartial, believing that the discussion following would bring out anything neglected from your side. This is particularly for your interest because of the radical position I assume. I wished to bring out everything there was to bring out from the standpoint of the rhinologist, realizing fully how much there is to be said from the standpoint of the dentist.

The Doctor who spoke about the nasal septum and expressed a doubt that children did not very often fall on their noses in early life is very much mistaken there. You will realize this if you stop to consider that a

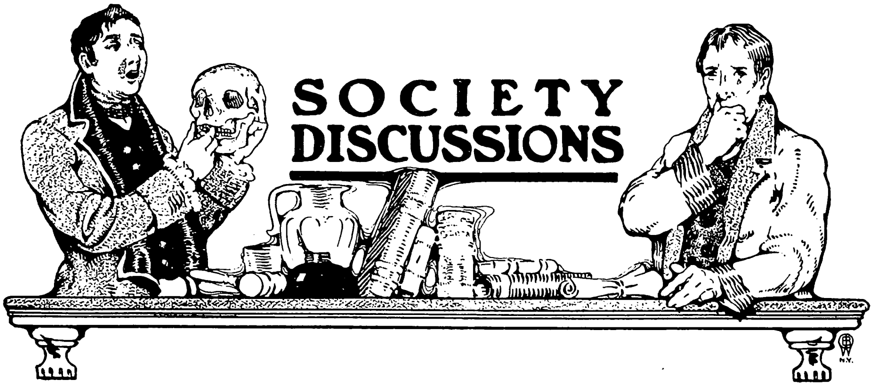
man's nose is the most prominent part of his face, and that in the first few years of life children in crawling about and learning to walk get blows on their noses from one to a dozen times a day. Many times they are not of sufficient force to call attention particularly to the nose, but it is not an unusual occurrence to have them suffer so that the attention of the parent or nurse is called to it. The septum in infancy is a very weak structure, almost entirely cartilaginous. We can easily understand how a blow that is not of sufficient force to deflect or break it will, by the injury inflicted, cause an influx of blood, and some slight injury be the seat of a deviation later in life.

The most natural thing in the world is to have just a slight deviation or a little knot on one side or the other; just enough to cause it to develop along the lines of that little irregularity. It is one of the most unusual things in the world to look at the nose of a child and find it without some slight deviation, or a little knot or shelf that will develop if you start it up in the slightest.

I do not think that blows on the bridge have much influence, for when on the bony structure they must be of sufficient force to actually cause a fracture. It nearly always begins in the cartilaginous part of the septum, but frequently affects the bony tissue in the process of ossification.

I should like very much first to hear about Dr. Brady's idea of some heretofore unconsidered cause which he says is responsible for sixty per cent of the cases, and of course I shall have to defer an opinion until I hear what he has to say, but I think I dare venture the opinion now that I can trace the causes he gives to defective breathing in the sense given in my paper. I should say, too, that the conditions I have spoken of are in a certain sense *typical* irregularities, and it is the *atypical* cases mainly which are caused by conditions other than defective breathing. I have roughly made that flat statement without particular explanation for the purpose of bringing out all the criticism possible, because I am as anxious to learn the facts about this as you are. I am very thnkful to the orthodontists here for the pleasure of having read a paper, and I shall be well repaid and very well satisfied if it shall prove to be of any particular benefit.

I cannot close without offering my profound thanks for the many flattering things said of my paper, even by those who do not agree with me in many respects.



Central Dental Association of Northern New Jersey.

October, 1902.

The meeting was called to order by the President.

Dr. Charles A. Meeker read a communication from the Odontographic Society of Chicago, asking for volunteers to clinic at the fifteenth anniversary of that Society, to be held at Chicago, Illinois, February 15-17, 1903.

Dr. Meeker stated that he had accepted the invitation and would be pleased to receive the names of any members who would attend and give clinics.

The President then introduced Mr. Eustace Harold Gane, pharmaceutical chemist (London), member of the Society of Chemical Industry, who addressed the Society upon

The Chemical and Physical Properties of Hydrogen Dioxide.

Mr. President and Gentlemen: In inviting me to read this paper, Dr. Meeker said that he wanted someone to address this meeting who knew more about hydrogen dioxide than the average dentist does. I do not presume to have that knowledge, except perhaps, from a chemical point of view, for you will, I think, agree with me when I say that dental education is, perhaps, not as thorough as it might be in that direction. That is a matter to be regretted, as much dental work deals with questions which are purely chemical, rather than medicinal. So it occurred to me that perhaps the best entertainment I could afford you this evening would be, not to read a paper, but to give some demonstrations of what hydrogen dioxide will do, in the hope that after seeing them you will be

able to deduce therefrom something which may be valuable to you in your work, or apply some of these tests in the solution of problems occurring in your daily practice.

The subject is by no means a new one. Hydrogen dioxide was discovered as long ago as 1818, but up until the last few years has been regarded almost as a chemical curiosity. It was a body that few seemed to take much interest in and that nobody cared to manufacture, the early investigators describing it as a dangerous compound, and one which could not be handled by manufacturers or used by practitioners.

Hydrogen. As you know, it is one of the oxides of hydrogen. Hydrogen is particularly interesting at the present time, owing to the fact that it is only within the last few months that we have been able to ascertain just what hydrogen is.

For many years and until within the last few years, chemists generally supposed it was a metal in gaseous form, and that if it could be solidified it would be found to possess all the properties of a metal. It was not until the experiment was actually performed, some time last year, that chemists learned finally they had been altogether wrong in their ideas of hydrogen, and that it is not a metal at all, but that it possesses some of the features of a metal and some of a non-metallic body.

Hydrogen combines with both acid and alkaline radicles forming definite chemical compounds, and, among these, it forms two oxides, one being the hydrogen mon-oxide, commonly known as water, and the other the dioxide, about which I am to talk to you tonight.

Hydrogen Dioxide. Hydrogen dioxide is found to some extent in nature, generally in mountainous places, in the air, especially in certain localities where the air is very pure, and particularly after thunder storms. It is found in dew; as a rule in small quantities in rain water and snow and it is said to be found in the neighborhood of the Jersey pine forests and to it is attributed some of the exhilarating effects, which the air of the pines is supposed to possess. It has also been said that the exhilarating properties of the air of Italy and the noted effect which it has on the voices of the singers, is due to the presence of minute quantities of hydrogen dioxide in the atmosphere. It is quite possible to detect its presence in places where the air is not contaminated by smoke or by gases from manufacturing establishments. It is to this body also that the properties of bone black as a purifying agent are principally due. Bone black is used largely in the refining of sugar and the manufacture of the alkaloids, and its decolorizing property is due to the fact that, when fresh bone black is mixed with water quantities of hydrogen dioxide almost immediately form. If

the moist bone black is exposed to the air for a few minutes it is perfectly possible to detect hydrogen dioxide in quite appreciable quantities.

Manufacture of Hydrogen Dioxide.

The method of manufacture usually adopted is from barium dioxide. This substance (exhibiting a sample) is prepared from the native carbonate of barium or from baryta by roasting in a stream of air or oxygen gas. By treating the barium dioxide with water and a mineral acid the dioxide is almost immediately liberated.

I will show you the process of manufacturing on a small scale.

(Mr. Gane here demonstrated by mixing some barium dioxide with water and adding hydrochloric acid. The supernatant fluid was poured off, and a few drops of permanganate of potash solution added. The permanganate was immediately decolorized by the hydrogen peroxide formed in the first instance.)

The process, as you will see, is a simple but at the same time a difficult one.

The difficulties arise after the dioxide is manufactured. The solution is turbid and requires to be carefully filtered: it will contain greater or less quantities of barium and that is where the difficulty arises in manufacturing a pure article—in getting rid, not only of the barium, but also of the substances used in precipitating the barium.

I have here some dioxide manufactured by some of our largest manufacturers, and we will see if they are all free from barium.

Impurities.

(Mr. Gane proceeded to test the purity of the dioxides referred to by pouring some 3 per cent solutions into boiling tubes, and adding dilute sulphuric acid. The presence of barium was evidenced in one of them by the formation of a white precipitate of barium sulphate.)

Dr. Meeker.

Is sulphuric acid the one that we should try the hydrogen dioxide with to find out whether it is pure, or not?

Mr. Gane.

That is one method; if you get any precipitate at all you may rest assured it is due to the presence of barium.

Hydrofluoric acid is another impurity which we sometimes find; it is due to the use of that acid to decompose the barium dioxide, and is a dangerous impurity owing to its toxicity and its liability to increase the coagulability of the blood.

In the text books in vogue you will find statements to the effect that hydrogen dioxide solution is extremely difficult to preserve and cannot be kept, without the addition of hydrochloric or some other acid. While

it is true that these acids do tend to prevent the decomposition of the solution it is equally true that there is no real necessity for their presence.

As we learn more and more about the properties of this substance, we find that the purer it is, the better it will keep and the less necessity there is for the addition of preservatives. If we get a perfectly pure preparation I think I am safe in saying there is no necessity for adding any preservative whatever, and while it is almost impossible to get rid of every trace of acid when manufacturing on a large scale, it is possible to prepare a solution which does not contain more than one-tenth of one per cent of acid and which should not require more than about a drop of soda solution to neutralize 10 c.c. of the 3 per cent solution.

The pure peroxide—and by that I do not mean the aqueous solution, but the pure substance itself—has only recently been prepared and there have been a number of experiments published in the last few years tending to substantiate what I have just said, that pure hydrogen dioxide is a fairly stable body, and can be kept in concentrated form for a reasonable length of time. The only precaution necessary is to keep it in clean bottles and in bottles that have no rough spots on them, and to see that it does not come in contact with cork, rubber or with roughened stoppers.

Pure Hydrogen Dioxide.

(Producing flask). I have in this flask I think the first lot of pure hydrogen dioxide that has ever been exhibited in America. This substance, as you will see, has a dense, syrupy appearance and boils at about 80° C. (176° F.). It is not a solution, it is the pure hydrogen dioxide itself, with just a trace of ether (the last trace of ether is very difficult to get rid of and can only be done satisfactorily by distillation in a vacuum). This substance contains about 97 per cent of pure hydrogen dioxide and, as you will see, it can be boiled.

(Mr. Gane proceeded to prove the above statement by heating some of the pure hydrogen dioxide in a test tube over an alcoholic flame.)

Boiling Hydrogen Dioxide.

All the text books state that if you heat hydrogen dioxide up to the boiling point, it will explode, but I think you will see when it begins to boil, that it will not do so.

(Mr. Gane then proceeded to prove that pure hydrogen dioxide can be boiled in perfect safety, by bringing the hydrogen dioxide in the test tube to the boiling point.)

You see that it boils without any explosion and with very little decomposition. The little bubbling which you see is due to the small trace of ether that is present in the substance. Up to within the last few years any chemist who attempted to do what I am now doing, would have had

a wire mask over his face and have protected himself with iron plates from the force of an expected explosion. By this time most of the ether is gone and we have here what is practically pure hydrogen dioxide. (Handing test tube containing pure hydrogen dioxide to the President.) You will notice, Mr. President, that the substance has a somewhat pungent odor, which is irritating to the nostrils.

The President. What proportion of ether would be required to make it explode?

Mr. Gane. Ether itself is only explosive when mixed with air, but the addition of ether to the hydrogen dioxide tends to make the substance more stable. If the glass is clean and the solution pure there need be little fear of an explosion.

Tests. The simplest test for detecting the presence of hydrogen dioxide is by the addition of a little acid solution of bichromate of potassium. I will use the diluted solution so that you can see the coloration.

(Mr. Gane then proceeded to demonstrate by adding a little solution of bichromate of potassium to some 3 per cent. pyrozone solution contained in a test tube, then adding a few drops of sulphuric acid and some ether.)

Upon adding the acid bichromate of potassium the mixture becomes a dark red brown, owing to the formation of perchromic acid which dissolves in the ether to produce a beautiful blue tinted solution.

One of the simplest methods of determining the strength of solution of hydrogen dioxide is by means of the instrument I now show you which is known as a nitrometer.

(Mr. Gane proceeded to demonstrate the method of testing the strength of the solution by filling a nitrometer with strong brine solution and running into it 2 cubic centimeters of a supposed 3 per cent solution followed by a few c.c.s. of bichromate of potash solution acidified with sulphuric acid.)

In this way we measure the exact volume of oxygen gas that this solution is capable of developing.

It is one of the fundamental laws of chemical science that the molecular weight of any substances in grams will occupy in a state of gas eleven thousand two hundred cubic meters, and we should get from the 2 c.c.s. solution which I have placed in the nitrometer, which is supposed to be a 3 per cent solution, nearly twenty cubic centimeters of gas. As a matter of fact we get more than that because an equal quantity of oxygen gas is liberated at the same time from the bichromate solution and allowance must be made for that.

(Mr. Gane proceeded further with the above described demonstration.)

We have already about thirty-six centimeters of gas and if I allowed the reaction to go on it would run up to about thirty-eight.

I can demonstrate that what we have there is oxygen gas by taking a splinter of wood which is red with heat and allowing it to come in contact with the gas when it will immediately take fire.

(Mr. Gane proceeded to prove the above statement by heating the end of a match until it became red hot when upon allowing it to come in contact with the gas combustion was at once produced.)

You see the wood immediately catches fire owing to the violent oxidation caused by the presence of the oxygen gas.

Properties of Hydrogen Dioxide.

The properties of hydrogen peroxide are in many ways remarkable, especially its behavior with metallic substances. We should suppose it to possess the properties of both elements from which it is derived, and as a matter of fact it does, for it will either extract oxygen from a substance or add oxygen to it. Most metals when placed in contact with this liquid are immediately converted into their peroxides. There are one or two exceptions to this rule, notably gold, silver and platinum, which destroy the peroxide without being affected by the liquid. The metallic oxides are also oxidized by it and converted into their higher oxides.

I have here a number of substances upon which I would like to show you the action of hydrogen dioxide.

Here is a little metallic arsenic which is a difficult substance to oxidize, but which is almost immediately converted into arsenic acid by the peroxide.

(Mr. Gane proceeded to demonstrate the action of hydrogen dioxide upon metallic arsenic by placing a little powdered arsenum in a tube and pouring a few drops of the pure peroxide upon it. A violent reaction immediately took place, the tube becoming very hot and on addition of more of the peroxide the metal passed into solution.)

On metallic iron it has a similar action, although the action is not nearly as rapid as with arsenic.

I have in a tube here a little black oxide of manganese, a substance difficult to attack, requiring a strong acid to effect its solution, but it is almost instantly converted into a higher oxide by the addition of a little of the peroxide.

(Mr. Gane then demonstrated the truth of the above assertion by addition of some of the peroxide to a few grains of the black powder. The reaction was similar to that with arsenic, but less violent.)

All of these experiments illustrate the oxidizing property of hydrogen dioxide.

An experiment which I will now show you will illustrate its action in another direction. I have here some silver oxide, and, curiously enough, the action of hydrogen dioxide on this substance is just the reverse of what it is on the other oxides, for instead of converting it to a higher oxide it reduces the oxide almost immediately to metallic silver.

(Mr. Gane proceeded to demonstrate by adding the dioxide to some silver oxide. The reaction took place with almost explosive force, and the metallic silver was precipitated.)

All these properties which I have just illustrated render this substance extremely valuable to the chemist for analytical purposes. It is possible, with the aid of this substance to carry out oxidizing reactions in alkaline solution, something long desired but hitherto not attained. Perhaps the most valuable properties are its powers of converting all hyposulphites, sulphites and sulphides into sulphates; reactions which are sometimes very difficult to perform, but which are very speedily accomplished with the dioxide. I have here some solution of ammonium sulphide; it has a very pungent and nasty odor, something like that of ancient eggs.

(Mr. Gane proceeded to demonstrate by adding a few drops of the pure dioxide to a test tube half full of the yellow sulphide solution. The tube became hot, color and odor disappearing in about one minute.)

You observe that the solution has become decolorized, it is perfectly white and the odor has all gone, the sulphide has become converted into ammonium sulphate.

I might also add that mercuric sulphide, a substance extremely difficult to attack, is quickly attacked by the dioxide.

Incidentally this property makes it useful for the removal of sulphur from coal gas.

The uses of solutions of hydrogen dioxide in the arts are largely increasing, and new uses are being found for it every day, while the manufacture of it shows a steady increase from year to year.

Dr. Chas. A. Meeker. May I interrupt you a moment? You spoke of the action on mercuric sulphide; is that the result produced by old amalgam fillings in teeth?

Mr. Gane. I am not prepared to state just what the result of those old amalgam fillings on teeth is, but I want to refer to that matter a little later on.

Bleaching. One very great use of this substance in the arts is as a bleaching agent; it is used in the tanning industry, and despite its violent action on some leathers

it is an extremely useful substance by which to obtain a skin of uniform tint void of all staining and discoloration.

I will show you one or two experiments illustrating its action on certain animal and vegetable fibers. I believe that Dr. Meeker brought this matter to the attention of your Society some months ago and related a little misfortune which occurred to him by the spilling of a small portion of a twenty-five per cent solution on a lady's dress, so that he had to pay for a new dress. He was good enough to send me a portion of the injured fabric, a heavy woolen cloth, and I believe that Dr. Meeker was at some little loss to understand what caused the trouble. At the time it was attributed, I believe, to something in the cloth or in the dye, which was supposed to have caused the combustion and destruction of the cloth, but I will show you that the question of dye need not be considered, as we can attain the same results on similar fabrics of almost any color by the use of a little pure dioxide, thus illustrating the enormously powerful oxidizing properties of the substance. The affinity of the cloth for the dioxide is so marked and it takes it up with such rapidity as to soon set fire to the cloth, particularly if the fabric is warmed a little or exposed to a strong light, such as sunlight.

I have here a portion of the before mentioned dress, upon which I will put a little dioxide, and in a minute you will see something happen.

(Mr. Gane demonstrated by placing a few drops of hydrogen dioxide upon a piece of cloth; in a few seconds the cloth began to smoke, then to smoulder, and rapidly burst into a flame.)

Dr. Meeker. I was using a twenty-five per cent solution.

Mr. Gane. Yes, a twenty-five per cent solution will do the same thing in a little longer time.

With some substances the action is not quite so rapid, and a little heat is necessary in order to start it.

I have here some colored silk and silk velvet, which will behave very much in the same way, particularly if I warm it.

(Mr. Gane proceeded to demonstrate by subjecting three pieces of silk velvet, one black, one blue and the other red, to the action of hydrogen dioxide, the result being similar to that in the last experiment, the action however being more rapid upon the piece of black fabric than on the red or blue.)

It may be that the black dye has something to do with increasing the rapidity of the action owing to the fact that the dioxide has some action upon it as well as upon the cloth. The peroxide usually has little action upon the various aniline dyes, but most vegetable colors are slowly destroyed.

(Mr. Gane performed further experiments of like character with leather and with kid, such as is used for making gloves.)

There is no violent action on the leather, but the substance itself is absolutely destroyed, becoming in a short time but a mere pulp.

Germicidal Influences. Another valuable property of the peroxide is its germicidal action. According to the best investigators it is among the most powerful germicides that we possess, being almost half as powerful again as mercurial chloride, and far superior to carbolic acid or similar preparations. The only objection to its use is that it cannot be used as a preventative antiseptic, owing to the readiness with which it attacks organic matter, but where rapid sterilization is desired there is no substance that will produce such good results as hydrogen dioxide.

Some years ago two French chemists conducted a series of investigations which showed that it was a complete sterilizer of water. One c.c. of a 3 per cent solution added to 100 c.c. of water will sterilize it in about an hour, and will destroy almost all forms of pathogenic bacteria; it should therefore be useful in hospital wards where sterilized water is required and the necessary sterilizing plant is not obtainable. Its use is in some ways better than boiling, because boiling will not destroy pathogenic bacteria except after long heating. One investigator recently went so far as to say it was absurd to attempt to sterilize water by boiling, if it was to be used for drinking purposes, inasmuch as bacteria possess the peculiar property, as soon as they feel an enemy approaching, of sporulating, and that when one starts to boil water the effect on the bacteria is to make them immediately form into spores, in which state they will resist heat for many hours, so that boiling the water simply serves to concentrate the bacterial solution.

The addition of a little dioxide will destroy them entirely, spores and all, seeing that hydrogen dioxide is one of the most deadly substances to animal protoplasm that we possess. For this reason it is found useful for brewing operations, brewers being able to gauge their fermentation with a great deal more exactitude than they could do a few years ago. By using very weak dilutions it is possible for the brewer to kill all acid producing and mould organisms, while at the same time allowing the process of alcoholic fermentation to go on. Under the old method, after alcoholic fermentation had gone on for a certain length of time, it was necessary to kill the ferment by boiling, but now by the addition of a stronger solution of the peroxide the alcoholic ferment is killed completely, and a finer grade of beer is said to be furnished than we have hitherto been accustomed to consume.

An interesting point in this connection is that while the dioxide,

if the solution be strong enough, will instantly destroy all organized ferments it has no action whatever on unorganized ferments, such as diastase, the ferment of the saliva, pepsin and pancreatin. I can show that to you, in a few minutes by the aid of a little starch solution which I have here.

(Mr. Gane proceeded to demonstrate by adding a solution of diastase to some starch paste mixing with some 3 per cent pyrozone solution, and warming the mixture to about 40° C. for ten minutes. After that time the starch mixture instantly reduced Fehling's solution, showing conversion of some of the starch into sugar.)

Action on Vegetable Fibres.

An interesting point, in considering the action of peroxide on animal and vegetable fibers was raised a few years ago by a pharmacist of Philadelphia who was suffering from ivy poisoning. The trouble was most severe about the wrists and was treated by bandaging the wrist and keeping the bandages moist with a 3 per cent pyrozone solution. After having kept the bandage wet for a few hours, he felt a very severe pain at the wrist, and upon unwrapping the bandages found they were charred. He attributed that to the presence of a small quantity of acid in the solution which he thought became more concentrated as he added more peroxide, but the speaker showed shortly afterwards in one of our technical journals that the acid had nothing to do with it, and that the same process would go on in an alkaline solution, or if the solution was perfectly neutral. The constant wetting of the bandage had concentrated the solution, and the heat of the wrist was sufficient to start the action which set the fiber on fire, as I demonstrated a little while ago.

There is a marked difference in the action of dioxide on cotton, and on animal fiber. You saw the effect it had on animal fiber, and I will show you that it has very little on vegetable fiber. It seems to have but very little effect on it even when it is heated gently. If some of the pure dioxide be placed on absorbent cotton it ignites but burns much more slowly than ordinary absorbent cotton will do, which generally when being ignited goes off with almost a flash.

(Mr. Gane demonstrated by saturating a small quantity of absorbent cotton with dioxide and setting fire to it; the saturated cotton burned slowly and with a bright flame, and for some time, instead of being consumed rapidly, as absorbent cotton usually is.)

Uses in Microscopy.

Concerning its use in microscopy, it is generally used for bleaching purposes and is particularly useful for bleaching tissues in bulk, as it has not the injurious action as have chlorine and other bleaching agents.

It is also particularly useful in removing the stains from sections

stained with osmic and is also of service in removing gum and other substances which interfere frequently with certain operations.

Uses in Dentistry.

And now a few words as to its use in dentistry, a subject about which most of you know more than I do, and I touch upon it only because I hope that the discussion which may ensue will bring out something valuable to both of us. Hydrogen dioxide has suffered a great deal from the erroneous claims that are being made for it by manufacturers and other interested parties. Frequent statements are made of its value for almost every disease under the sun. In one pamphlet I picked up this morning I found it recommended for use in yellow fever, malaria, gout, grip, tuberculosis, smallpox and even in sunstroke. Its method of use in sunstroke is rather peculiar. The directions in the pamphlet read that "if the patient is unconscious two or three ounces should be injected into the rectum." It reminded me of the story of the old doctor who was called to attend a patient suffering from smallpox; the doctor said he could not do anything for the smallpox, but could give the patient something which would give him fits, and he was death on fits! (Laughter.)

Another statement made is that it acts as a stimulant to granulating tissue, which is extremely far from the truth. As a matter of fact it is not one of those preparations that should be applied indiscriminately to granulating tissue. When once the tissue has commenced to granulate, the granulation is so delicate and the action of the peroxide so vigorous that the delicate granulations are sometimes destroyed, and it is possible to keep a wound open a very long time, by the use of peroxide, which would otherwise close up by processes of nature.

Bleaching Teeth.

Its greatest value to the dentist is as a bleaching agent for the teeth and as a mouth wash. Here I might add a word as to the value of this preparation when combined with other substances. There are now on the market a few stable preparations of hydrogen dioxide which will keep almost indefinitely under ordinary circumstances, and it is quite possible for the purposes of the dentist to add to these solutions certain flavoring agents, preparations like listerine and solutions of various kinds, provided only that the solutions are not alkaline, and to produce a preparation which will keep for say a week, quite long enough for the patient to use, and which are valuable additions to the dioxide itself.

Concerning its action on discolored teeth, I should like to show you one or two experiments which some of you may have seen performed by Dr. Kirk at a meeting of the Odontological Society about a year ago, by which he showed in a very interesting manner just how these various stains on the teeth come to be formed. As he put it, in the early stages

of tooth discoloration, a pinkish color is noticed, which is due to the diffusion of hemoglobin through the tooth structure; the red blood corpuscles become ruptured in some way and the coloring matter finds its way to the tooth structure.

(Mr. Gane proceeded to demonstrate by showing some defibrinated blood which possessed a granular appearance due to the unruptured corpuscles, and then adding to it some ether which caused the blood to assume a homogeneous appearance due to the liberation of the hemoglobin from the red corpuscles.)

That is the first stage in the discoloration of a tooth, a pinkish discoloration due to this liberated hemoglobin. The next stage is the formation of a slight brownish color due to the gradual breaking down of the hemoglobin; the hemoglobin, as you know, will break down into hematin and globulin. Just what happens in the tooth we do not know, but we can produce a similar result artificially by the addition of an acid to the blood solution.

(Mr. Gane demonstrated by adding a drop of hydrochloric acid to a solution of the blood in water when the red color instantly changed to brown.)

This process goes on and on, and the brown color becomes darker and darker until we ultimately get a tooth that is almost black, due probably to the formation of some compound of iron, the iron being obtained from the hemoglobin, and the sulphur from the protoplasmic elements of the tooth pulp resulting in the formation possibly of sulphide of iron. While the pink discoloration is very easy to bleach, some of the brown stains are most difficult to remove, in fact they are not touched by hydrogen dioxide at all excepting after prolonged treatment. By a series of experiments Dr. Kirk showed that this brown discoloration could be bleached thoroughly with dioxide by the addition of a little oxalic acid.

(Mr. Gane here demonstrated by showing the immediate bleaching of a hemoglobin solution with a 3 per cent pyrozone solution. Another solution was reduced by addition of an acid when the brown color remained unaffected by the pyrozone solution. The hydrochloric acid was then neutralized with ammonia and oxalic acid added. Upon the addition of 3 per cent pyrozone solution the brown color was immediately discharged.)

Exactly that same reaction can be carried out in the tooth by adding a little oxalic acid and following it by the twenty-five per cent peroxide solution.

Dr. Meeker. Do you need to add the ammonia first?

Mr. Gane. That is not necessary in treating a tooth; the oxalic acid can be put on right away and then the dioxide.

There has been a great deal of discussion as to the action of peroxide on albumen and almost all writers look upon it as a coagulating antiseptic. If the experiment is conducted with solution of egg albumen that is true, but there are forms of albumen, and amongst them the albumen of blood serum, which is not coagulated by 3 per cent hydrogen dioxide. The albumen in serum must exist in some other form than it does in egg albumen.

(Mr. Gane proceeded to demonstrate the action on beef serum by adding first some 3 per cent pyrozone solution. The solution remained clear. The addition of some 25 per cent solution caused, however, quick coagulation.

You will thus see that the degree of coagulation depends on the strength of the dioxide solution.

Amalgam Stains in Teeth.

I desire to say a few words on the question of amalgam stains, which hitherto have been considered impossible to bleach. I do not say it is possible to bleach all forms of them, but I think there is a possibility of some of them being reached by chemical means. In chemical analyses when we cannot turn one substance into another that we want, directly, we try to turn it into a third substance and from that prepare the desired compound, and it seems to me this might be done in the case of some amalgam stains. That is why I drew your attention particularly to the action of hydrogen dioxide on sulphides. One of the earliest uses of hydrogen dioxide, which for a long time was a trade secret, was as a picture restorer. An oil painting discolored by age, due principally to contact with the gases present in the atmosphere, upon being carefully washed over with hydrogen dioxide, was restored almost to its normal condition. The reaction there is very simple. The white or light-colored portions of the picture has a basis principally of white lead, the sulphur from the atmosphere would turn that into sulphide of lead, and then the addition of the dioxide would turn the sulphide into sulphate, which was almost as white as the original white lead.

I have here some sulphide of lead which has just been freshly precipitated, and I will show you what effect hydrogen dioxide has upon it.

(Mr. Gane proceeded to demonstrate by suspending some freshly precipitated black sulphide of lead in water and adding a few drops of 25 per cent pyrozone solution. The black color quickly disappeared and a white precipitate was thrown down.)

Where you have an amalgam stain on a tooth, it seems to me possible to treat it along these lines. If that stain is due in the first place to deposits of the metal itself, it ought to be possible to convert it into a sulphide and then into a sulphate, which latter has usually very little color

or is soluble in water. I have tried this process on teeth which have been extracted and found it to work to some slight extent. But in the first place it is necessary to find out just what these stains are, whether they are due to tin or silver or whatever it may be, and then possibly by the addition of an appropriate chemical the metallic stain can be converted into a body which would be decolorized by the hydrogen dioxide. That is a point on which I should be very glad to hear the opinions of those present and discuss it with them.

Dr. Meeker. About ten or fifteen years ago there was a great deal of nickel used in filling teeth, and we now find such teeth are stained green. Can Mr. Gane tell us of any method of bleaching that green stain chemically?

Mr. Gane. I do not know that I could suggest anything offhand, but I should say that possibly by some such method as I have indicated there might be a chance of doing that. By the addition of a little sulphide of soda and an acid we might convert that nickel into a sulphide that would be decolorized very quickly by the dioxide. It would require a good deal of experimentation, and the putting of the sulphide into the tooth would be by no means agreeable to the patient.

Dr. Sutphen. Mr. Gane has told us that the addition of a small quantity of hydrogen dioxide in water destroys bacteria. In the summer time when we change our abode temporarily we are apt to be more or less affected by the change of water creating a severe diarrhea, which is very noticeable at our annual meetings. If we put a few drops of the hydrogen dioxide in the water would it stop that action? Is the effect of the water due to the different bacteria that we have there?

Mr. Gane. Probably it is partly due to the bacteria and partly to the salts in solution. If it is due to bacteria I should say that the addition of fifteen or twenty drops of hydrogen dioxide to a tumbler of water, and then allowing it to stand for a few minutes would be a good provision for any one to make when drinking foreign water. It would act more quickly if the water was not iced.

Dr. Luckey. Take an old-fashioned amalgam, silver, tin and mercury, stain. That stain, as we understood, was due to the oxidation of both the silver and tin, in proportions equal to the proportions in which the amalgam was originally compounded. Would the use of sulphide of ammonia, in the first place, convert that oxide into a substance that could be acted upon by the 25 per cent dioxide or a higher per cent, and so bleach the tooth?

Is that the impression that you meant me to receive or meant to convey.

Mr. Gane. Hardly so. In the first place I think it is impossible that these stains should be due to oxides. The term "oxidation" is very loosely applied to an indefinite number of chemical processes, some of which are not oxidation at all. Those stains are probably due not to oxidation but to combination of the metal with substances from the tooth and subsequent reduction of the metal, or combination with sulphur or organic compounds arising from the breaking down of the tooth structure. The impression I desired to convey was that possibly if those things were of a metallic character the addition of sulphide of ammonia or soda might convert it into the sulphide of the metal, which in turn can be decolorized by hydrogen dioxide.

Dr. Cuckey. What would you say if I said the stains were found under an ordinary amalgam filling after it has been in the tooth a number of years? We frequently find that the surface of the cavity is as black as your trousers and almost as hard as flint; and the excavater will go through it and leave a gloss. Would you attribute that to the penetration of these metallic salts into the dentine of the tooth, or would you attribute it to some oxidation, or reduction as you just nominated it, of the metal? What would you call that black dense stain?

Mr. Gane. Possibly it is due to combination of some of the fluids of the tooth with the metal and the subsequent reduction.

Dr. Cuckey. Then the application of ammonia you think would change that product into another product which the dioxide would act upon?

Mr. Gane. That is the idea.

Dr. Cuckey. We can handle organic stains, but it is metallic stains that puzzle us.

Mr. Gane. That was the idea I intended to convey, and I pointed out that the first thing to do is to find out just what those stains are. We do not know just what they are, and when we do we can probably provide some adequate remedy. This idea was only thrown out as a suggestion of the direction in which to work.

Dr. Cuckey. Another point I would like to speak about is where you mention the action of dioxide on new granular tissue, warning us of its tendency to break down those new granules, and it brought to mind a case that went through

my hands this summer, because pyrozone or dioxide, or what you choose to call it, is not only used by us for bleaching teeth, but it is used very largely, and I think more largely for the treatment of pulpless teeth and abscesses than it is for bleaching. While summering in Maine one of my children fell upon some rocks, the result of which was the formation of a tremendous abscess on his thigh, probably five inches in diameter. My family were at a point where there was no chance for medical attendance, and I fortunately arrived on the scene a day or two after this developed, and as a thoughtful man and as a man who appreciates a good thing after he has met it and seen it, I had sent up some half dozen or more bottles of pyrozone in the outfit, and at once went to work with the boy. I treated the abscess; I washed it; I sent to the nearest town for a syringe and treated it with pyrozone and thermaline and I did not find any ill results, in granulation, from my daily washings with a 3 per cent solution, but instead I found a very beneficial result; I found the wound closing. When I first discovered it it was nearly three inches deep, and I could draw out the pus by the cupful, almost; it was an enormous hole, and I was afraid the boy was in a very dangerous condition. But I found that granulations were formed, and that the cavity was filling up rapidly, and in the course of three days we had it so healed that there was no occasion for further attention. I gave the credit for the successful treatment to pyrozone. If pyrozone has this injurious effect on new granular tissue it seems to me there would have been a retardation rather than an improvement, after a certain point in the treatment, but I persisted in it until the end.

That seems to contradict what I understood you to say; I simply give it as a practical experience, not that I wish to conflict in any way with what you conceive to be the action of the drug.

Dr. Meeker. The general formula for amalgam that we use is about 60 per cent tin and the balance silver. Where comes the greatest oxidation in a tooth where the pulp is alive, from the silver or from the tin?

Mr. Gane. From the silver, probably, I should say.

Dr. Meeker. Then would you use a different chemical to change the character of the silver oxide from that used to change the character of the tin oxide? Would it be necessary to use a different chemical to change either of those oxides, or are they identical?

Mr. Gane. No, they would behave differently with different chemicals, and special treatment would have to be adopted to meet the case.

Dr. Luckey. If it was silver, would you use soda or ammonia?

Mr. Gane. If it was in metallic form you could use ammonia.

Dr. Meeker. What would you use for the tin?

Mr. Gane. That is a problem I am not prepared to solve just now.

Dr. Luckey. In your judgment would it do any injury to the tooth structure by sealing within that tooth a 25 per cent solution of pyrozone and leaving it for a definite time?

Dr. Meeker. Do you mean in a living or dead tooth?

Dr. Luckey. Well, no man would seal it in a live tooth; I mean in a dead tooth, a pulpless tooth, for bleaching purposes. Would you in any condition, or could you in any condition, suppose any injurious results from such an application?

Mr. Gane. I should think an injurious result would be practically an impossibility, because the hydrogen dioxide would be gradually decomposed and there would be nothing left but water.

Dr. Eaton. What is your opinion of the action of 25 per cent solution on the sac at the end of the root?

Mr. Gane. Judging from results that have been reported I should say the action would be extremely beneficial so long as you have no dead matter there which would be destroyed by the solution; living tissue would not be affected similarly. There might be a slight temporary caustic action, but that would wear off speedily and leave no injurious results.

Dr. Eaton. Has anybody here experimented with that? It is merely a suggestion which came to me within a day or two.

Dr. Sanger. With a 25 per cent solution?

Dr. Eaton. Yes; first removing the pus with a 3 per cent solution, and then injecting your 25 per cent solution. Do you think there would be any harm come from it?

Mr. Gane. I do not know how any harm could come from it, but I really have had no experience in that respect.

Dr. Sanger. I was just wondering how the patient would like it.

Dr. Eaton. I do not imagine it would be very painful excepting for a few minutes, if you first removed the pus.

Dr. Sanger. The action would be caustic.

Dr. Baker. I would like to ask Dr. Eaton if he has ever used a 3 per cent solution on the sac?

Dr. Eaton. Yes, many times.

Dr. Baker. I had a case not a great while ago in which I used a 3 per cent solution in treating the root of the tooth, to wash out a sac, and it caused a great deal of pain. I applied it about four o'clock in the afternoon, and the pain increased after the patient left my office to such an extent that between ten and eleven she sought another dentist and had the tooth extracted. The pain was so intense with a 3 per cent solution that I do not know what a 25 per cent solution would do.

Dr. Eaton. I have treated three teeth in that way within the last week, and they all became perfectly comfortable.

Dr. Baker. Was not the pain intense?

Dr. Eaton. No, there was no pain.

Dr. Baker. Are you sure it went through the apex of the root?

Dr. Eaton. I am, for I got the pus. I am quite satisfied that the pyrozone went through the apex of that root.

Dr. Baker. If you had sufficient opening at the end of the root you would get your relief from the pyrozone.

Dr. Sanger. It seems to me that where you inject a 3 per cent solution of pyrozone, unless there is a free opening sufficient for the escape of the effervescent material you are bound to have pain, and if, in the rapid action which takes place debris is formed which stops up the opening in your tooth you have practically shut that gas in and the pain is going to increase.

Dr. Eaton. Perhaps that is so. In using the pyrozone I do so very carefully; I only inject a small portion and let that work out and then inject another small portion and then let that work out, and then in that way go on until I get no bubbling whatever.

Dr. Sanger. Do you use a 3 per cent solution?

Dr. Eaton. Yes.

Dr. Sanger. If you use a 25 per cent solution you do not get as rapid a breaking down for the reason that it is self-eliminating. You stop up the entrance to the tissue because you form as it were a coat on the outside.

Dr. Eaton. With the 25 per cent solution?

Dr. Sanger. Yes.

Dr. Eaton. Well, I do not use a 25 per cent solution.

Dr. Sanger. No, I was speaking of the use of it in destroying the pus sac.

Dr. Meeker. I have used a 3 per cent solution for years and in that connection I desire to speak of the use of a syringe, which is a little platinum point with a rubber bulb on the end; you can use it to perfection in abscesses and in the teeth, and with the 3 per cent pyrozone it can be used with great ease.

Dr. W. P. Richards. I have in my mouth a piece of bridgework composed of platinum eighteen karat gold and high grade silver, and I would like to ask the essayist why it is when I use peroxide for my mouth I have a metallic taste, which with other preparations I do not have.

Dr. Baker. I would like to ask Dr. Richards what karat of gold he said he had?

Dr. Richards. Eighteen karat.

Mr. Gane. I think that is the natural taste of the dioxide itself; it would have absolutely no action on the gold provided the gold be eighteen karat; if it is amalgam with zinc, or some other metals, there is quite likely to be a little erosion and a little oxide of zinc might form and give the metallic taste. But as far as my own experience goes, the dioxide itself has a slight metallic taste and the purer it is the more metallic it tastes.

I have nothing more to add excepting to thank you for your attention and to state that on the table there are samples of the 25 per cent solution to which we would be very glad to have the members of the society help themselves.

On motion of Dr. Sanger a vote of thanks was tendered Mr. Gane for his admirable discussion of the subject.

On motion adjourned.

Second District Dental Society.

Meeting of November, 1902.

A regular meeting of the Second District Dental Society of the State of New York was held on Monday evening, November 22, 1902, at the Kings County Medical Library Building, No. 1313 Bedford avenue, Brooklyn, N. Y., the President, Dr. Hamlet, occupying the chair. In introducing the essayist of the evening, Dr. Levitt E. Custer, of Dayton, Ohio, the president spoke as follows:

Dr. Hamlet. I do not think it is necessary for me to say much, but I just want to allude to the subject before introducing the essayist. It is a subject that should interest us all. So much has been said and written concerning the therapeutic and the defining or exploring value of the X-ray, that it is of great interest to us to have it applied to dentistry. The treatment of perplexing conditions in the oral cavity, especially those akin to pyorrhea alveolaris, are but a comparative success when we consider the wonderful cures that are made with the X-ray in epithelioma and other cutaneous diseases. If the X-ray can be made available to all dentists, I am sure we will have many opportunities for its use. I take great pleasure in introducing to you Dr. Levitt E. Custer, of Dayton, Ohio, who will talk to you on the subject of "The X-ray Made Available for All Dentists," and give clinical demonstrations.

The X-Ray in Dentistry.

Dr. Custer: That which I have to present is merely an informal talk for mutual benefit on a subject of interest to you and to me. I realize that I am in the presence of one of the original workers with the X-ray, and that I only took up the work after he had made considerable progress in it; but I believe I am also addressing men who have not given the subject much thought, so one will be considerate of the needs of the other, and we will try to make it a beneficial evening for all.

To fully understand what the X-ray is, I have prepared as far as possible a chart giving you the air vibrations with which you are more or less familiar. When a person goes on a high mountain, he often finds difficulty in breathing or supplying the blood with oxygen, because of the rarity of the air, and at the same time he also notices a difficulty in hearing. Those instances are sufficient to bring to your mind what the value of the atmosphere is to us as human beings. If I place an electric bell under the receiver of an air pump, and begin to exhaust the air, having first heard the bell ring you will see the automatic vibrations, but you cannot hear the bell ring, because of the vacuum which has been produced, illustrating that the air is necessary for the communication of sound.

Ether Vibrations. Having made those points somewhat plain to you, as a means of comparison, we may take up ether vibrations. Ether is that agent which fills all space—a substance of which we know but little, and yet it is through its agency that we have all the manifestations of magnetism, electricity, heat and light—with the X-ray at one extreme, and wireless telegraphy at the other extreme. You will notice that while the air vibrations can be computed

by hundreds and thousands, the ether vibrations can be computed only by millions and trillions. Those things which are engrossing attention today are at the extremes of ether vibration, at the one extreme the X-ray, at the other extreme the Hertz wave or the agent through which the wireless telegraphy is made possible.

Having noted all these things, and the stage at which we have arrived, the thoughtful person would certainly believe that the end is not yet, that other phenomena will be made known, and that coming generations will have even more useful things.

The X-Ray.

The X-ray was made known by Roentgen in 1895. He gave it that name because he knew none other, and because of his modesty called it the X or unknown ray. It was said to have been discovered as an accident at that time, and yet we do not regard it so, because a year or two prior to that, Leonard had discovered a peculiar condition or zone or area around the Crookes tube, and had demonstrated some peculiarities, and it was in the following out of that idea that Roentgen possibly accidentally discovered the X-ray. From the time Crookes invented what is known as the Crookes tube, up to the time of the discovery of the X-ray, scientists had been at work, and the discovery of Roentgen, while somewhat of a surprise, was what had been predicted some years priorly.

The means through which the X-ray has been made possible is by the Crookes tube. Prior to the discovery of that tube by Sir Crookes, of England, the Geisler tube had been known—a tube in which there was a partial vacuum, 1 to 10, and it was the following up of the exhaustion of the air within these tubes to almost a complete vacuum, as experimented with by Professor Crookes, that we obtained that which led to the discovery of the Crookes tube. It differs very little from an incandescent lamp. In the latter the air has been exhausted so the carbon will not be consumed by the oxygen within, but the vacuum is low compared with that of the Crookes tube.

It is an easy matter to energize the force for a Crookes tube. We have on this board possibly eight or ten feet continuous length of tubes, and if the light is turned down in this room, I will show you the Geisler tube.

(Dr. Custer gave a demonstration with the Geisler tubes.)

The means by which the Crookes tube is energized for X-ray purposes are three: One is a Tesla coil, which has fallen into disuse because of the erratic ways of the current; the other is the static coil, or the plain Rumkorff coil. At first it appeared that the static instrument was the best one in use, but it was found in course of time that its current is not of the high amperage that can be derived from an induction coil, and for

that reason, where we wish to enter the X-ray work alone, we find that the induction coil, as I am showing you, is the best and most satisfactory instrument.

Following the advice of Dr. Kells, in my first experiments I purchased a Tesla coil; but I had it only a short time when I became satisfied that it was not the thing for dentists, nor for those who wanted to make a success of the X-ray, because the current is too erratic, and the destruction of tubes is so great that it is not practical for our use.

X-Ray Burns. The static machine was supposed at first to have the advantage that it would not burn, but there have been perhaps as many burns produced by it as by the coil, in proportion to the work that has been done. In an ordinary exposure, a person was not liable to an X-ray burn so much from the static machine as from the coil. The instruments have been improved so that at this time the production of an X-ray burn results only from ignorance or carelessness. Where there has been X-ray burning, I think the exposure has been scarcely shorter than fifteen minutes, and to produce an extensive burn would take thirty to forty minutes from a strong current. We have shortened the time of exposure; where formerly we took a number of minutes, it is now a matter of a few seconds. The margin of safety therefore is so wide that no one need fear to produce a burn in any practical case.

The tube which is used for the X-ray is a modification of the original Crookes tube. We have at one end the cathode from which the X-ray is developed, and it strikes the anode, and being placed at an angle of 45° throws the ray down so as to be available in the front of the tube.

Rumkorff Coil. The instrument which I show you tonight, and which I believe to be the simplest and perhaps the best for dental purposes, is the Rumkorff coil, with an electrolytic interrupter. I have here a fifteen-inch Queen coil. It is not necessary in dental operations to have an instrument of such high power, a ten or twelve-inch would do as well; but the length of time will necessarily be increased somewhat, while the average length of time consumed in the taking of a picture for dental purposes is from five to fifteen seconds as I am using it with this coil. If a person has a twelve-inch coil, it would not exceed forty-five seconds, as nearly as I can tell. In that length of time, almost any patient could be so quiet that you could get all the details without any fear of blurring by reason of the patient moving.

Cauldwell Interrupter. One of the particular things I wish to call your attention to is the energizing or getting the current. When the coil was first brought out, an expensive part of the appliance was the interrupter and the condenser, which was

necessary to go with it. That cost one-third of the whole amount. That has been done away with by the invention of the electrolytic interrupter. That which I prefer, and which I would recommend, is so simple that I only hesitate to give it to you, on account of its being so simple. This one was broken in transit, but it still shows the essentials of the Cauldwell interrupter. I will illustrate on the board what it means. I should have said in the beginning that the essential part of the induction coil is the means of interrupting the electric current. That is the means by which the primary and the secondary in relation to it will give you the enormous voltage.

Dr. Custer described the details of the machine.

There you have a spark fully fifteen inches in length, which will energize any tube that can be made with the present improvements in the making of tubes. I can only give you an idea of what it would produce; yet in that day we thought it was wonderful that it should do that. (Illustrating). That would be the very best current I could get from the interrupter at a fifteen-inch distance; so the improvement made through the Cauldwell interrupter has been one of the most valuable things introduced in X-ray work. On account of the simplicity of the appliance, and the cheapness of it, I stand here as an advocate of that interrupter. Dr. Price, who has done most excellent work with the X-ray, is an advocate of the Weyneld interrupter. I will not say a thing against what Dr. Price has done, but having used the Weyneld interrupter, and becoming disgusted with the erratic action of it, I think I am safe in saying that the Cauldwell interrupter is the best made for these coils. I say it not only to you, but Dr. Price knows my opinions too, relative to these interrupters. This is not an invention of mine. I am not showing anything which is particularly my own. What I show is something which through my work I have brought down to a simple, tangible thing for all dentists.

Skiagraphs.

The technique of the X-ray work in dentistry you are probably more or less familiar with. You probably know, through Dr. Van Woert, that the insulation or covering of the film was done with vulcanite so it might be placed in the mouth and subjected to the action of saliva. That was quite necessary where the exposure was over a minute in duration, but nowadays, where it is only five to fifteen seconds, it is hardly required. A film about the size of a postage stamp, or a little larger, is enclosed in two layers of black paper. This excludes the light; it is made something like an envelope, not necessarily sealed, made in two layers, and then to hold the two together, I put a flap on. Being placed within the mouth, the ray passing through the tooth or whatever intervenes, will

be received on the film. As to the particular character of film, I understand that the Seed people who make these films, have given some attention to this, and are making for dentists what is known as an X-ray film. It is stiff and heavy, and not like a kodak film, and will give a clear picture in detail.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

The points which we might consider, would be the location of a foreign body, the location of a tooth, telling the extent of a root filling, the extent of an abscess, the condition of an unerupted tooth, or whether there is one there at all. Rather than go to the trouble of having a lan-

tern slide exhibition, I have brought six typical cases, which I will pass around, and we will have them to refer to.

Fig. 1 shows an alveolar abscess of the left central incisor; you will also notice the condition of that root filling. I want to say that all X-ray pictures look as though the operations are poorly finished, or left unfinished, but that is because we do not get the full outline of the tooth. It would seem as though a filling is overhanging at the margin.

The X-ray does not show the fine edge of the tooth very often, but all metals stand out in bold relief against the background.

Fig. 2 is a condition of the third molar at the age of about thirteen years. You will see the enamel has been nearly finished in this development, and the dentine has been more or less completed, and around it you see the follicle walls.

Fig. 3 shows the outline of the antrum. Very often it is desirable to know where it is lowest, and here the X-ray is valuable in finding the lowest point for drainage.

Fig. 4 is an interesting case, as I happen to know something about it. It contains a number of gold fillings, and a gold crown is on the first molar. The posterior root has been entirely absorbed. There has been a chronic abscess for a number of years. The X-ray shows the posterior root has been absorbed; it is entirely absent.

Some of the illustrations show a retained temporary molar, in others the absence of a third molar. In those showing a retained temporary molar, if you look closely, you will see by the clearness of the skiagraph that there is clearly a break in the continuity of the bone. (Fig. 5). The age of this person is about twenty years. If there were any break there, it would show. The full details of the adjoining roots are seen. In this case, the preservation of that temporary tooth would be one which we should look to, and the treatment would be with a view of filling as soon as possible.

Fig. 6 shows an impacted third molar. We meet those conditions frequently, and in this case you see the exact position of the third molar. I have placed these pictures on the card, as typical of what knowledge you may expect to derive from the X-ray.

Method of Making Skiagraphs.

I was asked to-day how I obtain such clear results; whether the negatives were retouched, or anything of that kind. The negatives were not touched at all, and the secret of the clear definition or contrast is due largely to the photographic part. I would say my method has been, after I secured the negative, to print this on what is known as Argo printing paper. It is much like Velox. That paper has given the best results in my hands.

I shall, in a few minutes, ask some one present to be a patient, and go through the technique of taking an X-ray picture; but before that I will call attention to conditions which we always meet in the tubes which are specially desirable for dental purposes—a thing which is to be observed at the time of taking the picture. These tubes are susceptible of different conditions of vacuum, according to which you will have different appearances of the picture when developed. A tube of high vacuum is one in which the rays will be very penetrating, and will not be obstructed to any material extent by the bone. When there is a high

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

vacuum you will not have a very good definition between bone and flesh. With low vacuum, it cannot pass through the photographic plate, and the picture will be clear and distinct. In taking a dental skiagraph, we must have a condition of vacuum which will go through the bone and yet not so high as to destroy all the outline of the flesh. It must be high enough to go through the dentine at least.

Dr. Hatch. Are those terms "high and low vacuum" synonymous to "hard and soft tubes?"

Dr. Custer. Yes; hard tubes are of high vacuum; soft tubes are of low vacuum.

Dr. Custer gave a demonstration of the high and low vacuum tubes.

This matter of the degree of vacuum I might go over with you to-night, but you would not appreciate it until the time when you were at actual work; then you would notice the condition of the tube and would understand what is meant.

If there is anyone present who has an interesting case in his own mouth, I will be glad to take a picture for the sake of illustration.

Dr. Leroy stated that he had a lateral incisor in which there is a fistulous opening which has been treated by several operators. Dr. Custer took a picture with an exposure of ten seconds. (Fig. 7).

In my own practice, my assistant turns on the current while I hold the film; but this evening I will try to do them both at once. I have a foot switch with which I can open and close the circuit. I have been careful to keep these films back of the instrument, to see that at all times the ray was thrown forward, and the film I do not think has been light-struck. It is an important point in your work to keep all the films and plates out of the room and get as far from your working room as possible. I went on for six months before I ascertained the cause of the foggy pictures. They were in an adjoining room, but the light had gone through a brick wall, and had affected the plates. That hardly seems possible, but it is true. They should be in a lead box or something of that kind. It is desirable to throw the light as nearly perpendicular to the surface of the plate as possible. In an upper case, the film should be placed above, and in the case of the antrum, it should be placed a little in front of the ear, about an angle of thirty degrees from the angle of the mouth. In placing a film it is necessary not to place it straight back, but the end of the film should curve back at an angle of fifteen or twenty degrees from the surface of the teeth. With the lower teeth it is easier than with the upper. I generally place two films together, placing them face to face, thus getting a better result than if you only had one.

Dr. Van Woert. Don't you get a better picture on one film than on the other?

Dr. Custer. I have never noticed that.

Dr. Royce exposed himself to the X-ray for 12 seconds. (Fig. 8.)

Mr. William Matteson exposed himself for 11 seconds. (Fig. 9.)

These exposures are made at a distance of about 18 inches.

Dr. Keppy, exposure of 12 seconds for wisdom tooth which has never erupted.

In all these exposures I have given from 10 to 12 seconds. I have no doubt that two or three are overexposed, but none of them are under exposed. These I will develop, and have the prints at your next meeting.

The danger of X-ray burns is scarcely to be considered nowadays. In X-ray work one would think he should be especially careful. He should always be careful, of course, but with the present methods of working, and the short time required, the dentist may consider himself safe. As for the therapeutic part of it, while it probably does not come under our care, or never will, unless you are operating for physicians, I will say that the X-ray as a means of diagnosis and a therapeutic agent is creating a great deal of attention, and seems to be revolutionizing in one or two fields the methods of practice, especially in epithelial troubles. Superficial conditions of many kinds, which have resisted all other agents, seem to be benefited, and in many cases cured. Epithelioma, lupus and some malignant tumors, have been reported as absolutely cured by the X-ray.

Discussion of Dr. L. E. Custer's Address.

Dr. Van Woert. I am free to confess that I never saw a clearer demonstration and a more practical one than that of the speaker this evening. I am a little disappointed in one respect, and very much gratified in another. I am gratified, in that it demonstrates that there is something that will shorten the exposure. This I knew from demonstrations made by the Queen people in Philadelphia, some three or four months ago; but I had hoped in coming this evening Dr. Custer would present to the dental profession something of moderate expense, which every dentist might have in his office—not because I believe it is a practical thing for every dentist to have, however. Very few busy practitioners have the time to give to the details of making skiagraphs. My experience in that line has taught me that it requires a great deal of attention in the development of these negatives—just as Dr. Custer has stated he does not care to develop them here, because he wants his own laboratory.

If you place the films in the hands of an ordinary photographer, nine times out of ten they will be utter failures, because they do not know anything about it. If that is the case, how many of the gentlemen present have the means at their command, even if they have the apparatus as presented to you this evening, or a similar one, as you have seen me demonstrate, to produce the desired results? I think there are very few. Many of you present are amateur photographers, but that does not cover the ground by a long way.

Again, the question of the development of the pictures in a dark room or a suitable laboratory is a very marked consideration; yet the same thing can be done in an ordinary room. Some are present to-night

who were present at the demonstration given at the Odontological Society five or six months ago, by myself, and my partner, Dr. Dills. At that time, a picture was made of a superior central in the mouth of Dr. Ottolengui, which had been treated for an alveolar abscess by Dr. Rhein and the root filled. Those pictures were all developed in the rooms of the Odontological Society, putting out the lights simply. I have no prints of those pictures, but I have a negative of the tooth, made in thirty seconds. Dr. Custer does a great deal better when he takes it in ten, eleven or twelve seconds. I will not attempt to dispute the efficiency of the apparatus, but I will say there is more money locked up in a machine like this, or like the one in use in my own office, than any one dentist wants to store up, for the amount of X-ray work he has to do.

I thought Dr. Custer would present something within a radius of $100 that would produce good results. These pictures are perfect gems, and the results are marvelous; and for a man to get up and say he can do better, is simply absurd, because he cannot do it. How many of you gentlemen have cases enough to pay you to put an apparatus of this kind in your office? Do not think I am talking for business. I do not want the business. I went into X-ray work for the love of it. If you want anything of that kind in your office because you like it, and because you can afford it, why have it by all means—that is your privilege; but if you put it in as a commercial scheme, you cannot put in an apparatus of this kind or similar to it, for any amount of money that will make it profitable to you.

Another point is in the development of these pictures. How many of you have the experience to develop those pictures as they should be developed? When a patient comes in to us for the taking of an X-ray picture, the picture is not made and developed and the patient sent out of the office in ten minutes—not because we cannot do it, but we do not want to. We want to take time, as Dr. Custer does, to develop it; but if necessity forces us, we can do it. Dr. Custer could do it here tonight, too, if necessary, but what I am getting at is the practicability of this thing for the general dentist. I do not think it is an instrument that will be an adjunct to every dental office by any means, and if I had it all to do over again, outside of the fact that I love it and for the novelty of it, I never would spend the money that I have spent. The amount of money I get out of the X-ray work per patient does not pay for the running of the machine, the interest on the investment and the maintenance of the tubes. That may seem a great deal to say, but I think Dr. Custer will bear me out in that. I never have used the tubes Dr. Custer has shown. I use the adjustable vacuum tubes and the static machine.

Two or three years ago Dr. Custer came to my office one evening in summer—a humid, nasty, sultry night. I was using the static machine at that time, and they were not as good as they are to-day, and try as I would, I could not get a charge on that machine. To cap the climax, I had three calls over the telephone for a patient in the Brooklyn Hospital who had jumped over the wall and killed himself. He was wearing a splint and suture which I had put in, and they were hounding me to come there and take it out so they could prepare the body for burial. I finally took Dr. Custer down to the Morgue with me, put the body in shape for burial and then took him back to the office and tried the machine again, but without success. That is where the coil would be an advantage. Since that time, however, there have been improvements made in these machines. I can put a charge in now—I was going to say in a rain storm if necessary. The old way of loading up with chloride of calcium for drying purposes is practically done away with by the modification of the exciter, and its attachment. It is not necessary for me to go into details about that. The fact remains that a small static machine will do for dental purposes, and will give you for little money what you actually require. A company in Baltimore makes a machine that runs by hand, which, if my memory serves me correctly, sells for about $65 to $75, and I have seen pictures made in from fifteen to thirty seconds with a little boy turning the wheel; the whole outfit did not cost over $75. The influence of the weather is to be considered there, too.

In regard to protecting the films, I know that with an exposure of ten seconds there is little danger of getting any moisture on the films. But what is the use of taking chances, when the expense and time consumed in protecting them and making provision against the moisture, is so small? The velum rubber you can buy for that purpose; it is very thin, and it only takes a moment to cover it over; then you can throw it anywhere you like and it will not be spoiled from moisture or atmospheric conditions. Of course, you must not place it where the rays can get at it. I have found for general purposes, that a film cut in a little different shape from Dr. Custer's suits me much better.

The paper that we use is the same as Dr. Custer or any one else uses—perfectly black. The film is doubled and cut to a pattern of aluminum, placed in an envelope of the paper, folded in and the whole thing covered with velum rubber. I am bringing this up because there is a possibility that some of you who have not apparatuses and will not get them, may go to some one who will not give you as good a picture as Dr. Custer, in the time he makes it. It may be necessary for you to place the film on the lower jaw, or in some place where moisture would get at it during a minute or a minute and a half. On the other hand, it may

be necessary for you to lay it aside and wait for an hour or two, or take it to a photographer. If the outer layer of the covering becomes thoroughly saturated, and it is laid away for any time, you will have an utter failure. That has nothing to do with X-rays either—it is a photographic fact—and any of you who have done amateur photography know that. If you take pictures in a damp, wet climate and roll them up, throw them in your grip or trunk, and let them stand until you get home, to develop them, you will have no pictures. Why? Because the atmospheric conditions change. Any picture made of the mouth with a Crookes tube should be either protected from these very conditions or developed immediately.

Dr. Hatch. In only one thing I would differ from Dr. Custer, and that is in the matter of prognostication or prophecy. Dr. Custer said we would never have anything to do with the X-ray used therapeutically. I hope that is not so. I hope the day will come when we will derive some benefit from the use of the X-ray in the inflammatory conditions we are called upon to treat—pulpitis, chronic abscesses and such things. We have had no one who has experimented along that line. The medical profession have had good results in lupus vulgaris and sarcoma. I have been using for some years the positive electricity in the ordinary Van Woert cataphoric apparatus for reducing pulpitis and inflamed pulps, and I had hoped tonight to hear Dr. Custer say something along that line.

Dr. Sutphen, Newark, N. J. I have not gone into the subject at all, but I am more than repaid for the little journey I have taken to get here, and would have come many more miles to hear such a talk as we have heard tonight. It is a step in the right direction, and will become of great value to us in our work, although I cannot altogether agree with what Dr. Van Woert says in regard to the commercial use of it. We cannot always count in dollars and cents the value of the apparatus we put into our offices. We must attain results, no matter if it cost us more than we receive in that particular line. Therefore, I would take issue with him on that one ground. It is not the cost of the apparatus, nor what we get directly from it, which we must count in our office outfit. I think Dr. Custer is to be very much commended for the able and simple way in which he presented the subject, which I always considered a very abstruse one. He has made it very plain, and I thank him for it.

Dr. Ash. I had the pleasure, five years ago, of having an apparatus in my office for about a year, and I used it with varying results. I am

sorry I was not here early enough to hear what Dr. Custer said in relation to the preparation of the film when taking the skiagraph. I had never seen one taken, and I must say it seems to me a matter which a person may take up with comparatively little trouble, if he has the apparatus. I must take issue with Dr. Van Woert in regard to what he said as to a man requiring a great amount of photographic skill in connection with the development of the pictures. I am not egotistical enough to suppose I am a man of skill, yet I obtained satisfactory results. The very first picture I took happened to be a good one, and yet the next one looked like a cloud picture (on a very cloudy day, too), but I discovered the reason—an over-exposure. I had a great deal of pleasure, however, as well as some profit—not financial profit; but I do think it is a long way from being a thing which will be desirable or practical to put into every man's office. Every man does not have enough business along those lines to warrant him in having the outfit, and if there are enough men sufficiently near to a good operator in that line, I would say by all means go to that operator. I think I gained a little prestige with a few patients who came in and knew I had the X-ray apparatus—there are always people who think that way—but not enough to make it worth while for anyone to put in an apparatus.

Dr. Custer. I do not know that any of you appreciate better than I do myself the remarks of Dr. Van Woert. I can hardly express my satisfaction at hearing the complimentary remarks, as well as the issues he took. He is a man whom I honor very highly. The point on which we may carry on a moment's further discussion, would be regarding the expense. Perhaps the Doctor misunderstood my coming here, but it was to present a practical, and so far as possible, a comparatively inexpensive instrument or appliance for the dentist. While I am operating a fifteen-inch coil, an eight-inch coil with two or three times the length of the exposure, would give equal results—perhaps not quite so clear; but it is possible for a person to get an eight-inch coil, or even a ten-inch coil from some manufacturers at the regular selling price, with two tubes like this, which cost me an average of about ten dollars each. That would cost you in the neighborhood of $100; it certainly would not exceed $115. If you want to go into it more elaborately you might get a twelve-inch coil, which alone would cost about $125 or maybe $150. When a coil has been made beyond eight or ten-inch length of spark, the problem of insulation inside becomes serious, and the increase seems to be almost by the square of the spark. This coil cost me about $300. An eighteen-inch coil would have cost about $400, and yet I may say I rarely, if ever, have needed a fifteen-inch spark. I say that in confirmation of what I said

first, that probably an eight-inch coil would be all a dentist would require.

As to the advantage of the coil over the machine which Dr. Van Woert brought up, it works at all times and is not affected by atmospheric changes, and takes a minimum amount of room. You can see how little room would be required.

Regarding the development, Dr. Van Woert is absolutely correct. Every dentist should develop his own pictures. He will find it necessary to do so, and his first lessons should be taken under the guidance of a good photographer. Many things could be brought up about the development, which would be only matters between Dr. Van Voert and myself. I do not think you would appreciate them until you got into the work yourself, and, therefore, I will not burden you with those details.

As to the time of exposure, I have gone to the limit tonight, because it is easier to modify an over-exposed picture than one which is not fully exposed. I have gone to the full limit. I will develop the one where we had to stop suddenly, and no doubt you will see as good results with that as with the one of ten or twelve seconds. If I have overexposed, it is an easy matter to get a good picture in the end, with photographic manipulation. I always like to be sure, and take plenty of time. Dr. Van Woert is right in saying that it is not practical for all. You need not to expect to make any money out of it. You will only have the satisfaction of having those things yourself, and being perhaps a little more appreciated by your patients. You will not get the value in dollars and cents. If your patients know you have this appliance, they will have more confidence in you, and it is a good thing for you to have; but you need expect no monetary reward,—at least in the cities where you are. If you live in the small cities scattered over the country, the opportunities for X-ray work are considerable. I am sorry I cannot speak to those men personally. They will find if they engage in this kind of work, that the physicians will be more than glad to come to them for two reasons—it relieves them of the annoyance, and, besides, a physician would rather go to a dentist with those cases than to a brother physician.

The question of dental therapeutics was mentioned. You will not get therapeutic action until you approach the margin of an X-ray burn. Let me repeat that—only when you are on the margin of an X-ray burn will you get therapeutic effects. The cases which the physician treats are desperate, and an X-ray burn is as nothing compared with the disease they are treating.

One gentleman brought up the point that there is no great care needed in the photography of the X-ray. That is almost the secret of the whole thing—the development of the picture.

Dr. Ash. I said not a great deal of skill. It may require care.

Dr. Custer. I still maintain my position. If I were to tell you all that has been done in order to attain an ordinary knowledge of chemistry in photography, I think you would come to the conclusion that there is a great deal of skill required. I have reached the point where I think it is the development almost entirely that gives a good, crisp, clear contrast, and I cannot get it with ordinary skill. I have discarded all the developers except the bromo-hydroquinone. I was a long time reaching that point. Perhaps Dr. Ash used the bromo-hydroquinone the first day he started out. I did not.

As I said a moment ago, physicians would be glad to accept your services in the smaller towns, and then you may expect to make a little money, setting apart a definite hour of the day.

Matter intended for publication should be addressed to the EDITOR, 80 W. 40th St., New York.

EDITORIAL

The Great Odontographic Society Meeting.

The sixteenth and seventeenth of February, 1903, must ever remain important dates in the history of dentistry, as marking an era, an epoch-making meeting having been successfully held at the time in the city of Chicago under the auspices and management of the Odontographic Society. The record is one to be proud of; five essayists, one hundred and twenty-five clinicians, and more than two thousand visiting dentists. No meeting of such magnitude has ever been held before. It is easy to say that the crowd was large, but in this instance we have proof of the assertion for any incredulous reader. In the first place no one was admitted to the hall without first registering and receiving a society button. Secondly, a supply of fifteen hundred programmes were exhausted at the first morning's session, so that a thousand extra copies had to be quickly obtained, and to the credit of the committee be it reported that these were at hand before the close of the afternoon. Lastly we have reproduced and offer with this issue a flashlight photograph taken at the end of the first night's session. It does not of course include the full attendance, yet enough remained to convince the most skeptical of the size of the meeting. But the picture is remarkable not alone because of the numbers of men depicted, but also for the fine likenesses. With a read-

ing lens it is easy to recognize faces even at the far end of the hall, and it will be a pleasant pastime to look for one's friends, many of whom will be easily found.

The Essays Read. The essays were limited to five and all proved to be admirably adapted to the occasion. The opening paper was presented by Dr. A. E. Webster of Toronto, entitled "The Value of Amalgams, Cements and Gutta Percha as Barriers Against Bacteria." The paper was based upon innumerable laboratory experiments carried out as efficiently as is possible in such work, the conditions of the oral cavity being reproduced as far as could be. The deductions of main interest were that practically nothing permanently excludes bacteria, that is to say neither amalgam, cements, nor gutta percha. Gold fillings have not yet been tested. A point of clinical interest is that gutta percha points in combination with chloro-percha seal roots better than where gutta percha points alone are used. Of the cements, oxychloride seemed the only one that at all inhibited bacterial ingress. Amalgam was reported as excluding bacteria only sixty days.

Dr. E. C. Kirk read a paper, the third in his present series, entitled "The Saliva as an Index to Faulty Metabolism." This was one more of Dr. Kirk's reports of the work he is doing in examination of saliva, and being most beautifully illustrated with his lantern, which has a polariscope and microscope attachment, was received with marked enthusiasm.

Dr. H. P. Carlton, of San Francisco, read a paper on Dental Education which brought out a prolonged and more or less antagonistic discussion. While many of the essayist's views may have sounded somewhat radical, there is little doubt that when the paper is thoroughly studied it will be found that his tenets are sound.

Prof. W. Warrington Evans, of Washington, read a paper discoursing upon the esthetic possibilities in prosthetic work which was as timely as it was ably presented. Prof. Evans has made a life's study of prosthetic dentistry and anything from his pen is always interesting and instructive.

The programme proving too lengthy for the two days originally set aside for the meeting, Dr. Ottolengui's paper on "The Rational Use of Porcelain for Filling Teeth" was scheduled for Wednesday morning, at which time, there being nothing more to come, everybody was at hand

and felt free to take part in the discussion which proved to be the liveliest of the meeting. The essayist had forwarded two teeth with cavities for which he had made fillings with Jenkins body, and in these Dr. Reeves, using a platinum matrix and high fusing body, made two fillings likewise. A committee of five examined these and selected both of Dr. Reeves's fillings as having better margins, though admitting that neither was as well contoured. The consensus of opinion at the termination of the discussion seemed to be that perfect fillings can be made with either high or low fusing porcelain, and with either the gold or the platinum matrix. The claim that high fusing body is stronger than the Jenkins enamel was practically abandoned.

The Banquet.

On Tuesday evening a magnificent banquet was furnished, at which seven hundred and sixty-four dentists were served. The toasts were from Canada, the North, East, South and the West. While all the speakers acquitted themselves in keeping with the inspirations of the occasion, the speech of Dr. Root, of Kansas, was especially worthy of mention, being from beginning to end witty and mirth provoking to a remarkable degree.

After the set speakers had been heard, the chairman most fittingly called upon Dr. Bently, who sketched the rise of the Odontographic from a very small beginning to its present position as the largest local organization in the world. He told an instructive story of the machinery which had been at work to accomplish the great success which had been achieved in this remarkable meeting. It might all be said in a single word, co-operation. The committee wrote to all States in the Union soliciting and eliciting support, with the result that a great lesson has been learned. If united in any effort the dental profession must prove an irresistible force. No one could have been present in Chicago during this meeting without feeling prouder than ever of being a dentist.

SOCIETY ANNOUNCEMENTS

National Society Meetings.

National Dental Association, Asheville, N. C., July 28.

National Association of Dental Examiners, Asheville, N. C., July 24, 25 and 27.

State Society Meetings.

California State Dental Society, San Francisco, June.
Colorado State Dental Association, Denver, June 16, 17, 18.
Connecticut State Dental Association, Hartford, April 21, 22.
Florida State Dental Society, Seabreeze Beach, May 27.
Georgia State Dental Society, Tallulah Falls, June 9.
Idaho State Dental Society, Boise City, June 9.
Indiana State Dental Association, Indianapolis, June 30, July 1, 2.
Maine Dental Society, July 21, 22, 23.
Maryland State Dental Association, Baltimore, March 28.
Massachusetts Dental Society, Boston, June 3, 4.
Minnesota State Dental Association, Minneapolis, Sept. 1.
Mississippi Dental Association, Vicksburg, May 19.
Missouri State Dental Association, Kansas City, May.
Nebraska State Dental Society, Lincoln, May 18.
New Jersey State Dental Society, Asbury Park, July 15, 16, 17.
New York State Dental Society, Albany, May 13, 14.
Ohio State Dental Society, Columbus, Dec. 1, 2, 3.
Tennessee Dental Association, Chattanooga.
Texas State Dental Association, Houston, May, 1903.
Vermont State Dental Society, Burlington, March 18, 19, 20.

Massachusetts Board of Registration in Dentistry.

A meeting of the Massachusetts Board of Registration in Dentistry, for the examination of candidates, will be held in Boston, Mass., March 4, 5 and 6, 1903.

Candidates who have applied for examination will report to the Secretary, Wednesday, March 4, at 9 o'clock, a. m., at Tufts College Dental Infirmary, corner Huntington and Rogers avenues, and come prepared with rubber dam, gold, plastic filling materials and instruments, to demonstrate their skill in operative dentistry. Any one who wishes may bring his patient. So far as possible patients will be furnished. The Board in every instance selects the cavity to be filled. Partially prepared cavities never accepted.

The theoretic examination—written—will include operative dentistry, prosthetic dentistry, crown and bridge work, orthodontia, anatomy, histology, surgery, pathology, materia medica, therapeutics, physiology, bacteriology, anesthesia, chemistry and metallurgy, and will be held at Civil Service Rooms, State House, from Thursday, March 5, at 9.30 a. m., until Friday p. m., March 6.

All applications, together with the fee of twenty dollars, must be filed with the Secretary of the Board on or before February 25, as no application for this meeting will be received after that date.

Every candidate for examination must be twenty-one years of age.

Application blanks may be obtained from the Secretary.

Candidates who have taken an examination, and failed, and desire to come before the Board again at this meeting are not required to fill out a second application blank, but must notify the Secretary as above in order to be examined. The fee for third and subsequent examinations is $5.00.

G. E. MITCHELL, D.D.S., Sec.

25 Merrimack street, Haverhill, Mass.

Southern Wisconsin Dental Association.

The Southern Wisconsin Dental Association will hold its annual meeting at Janesville, Wisconsin, May 20 and 21. Every effort is being made to have a large and interesting meeting. Prominent members of the profession will present papers and some of the most noted clinicians will operate. All reputable members of the profession are cordially invited.

Clinton, Wis. C. W. COLLVER, Secy.

SOCIETY ANNOUNCEMENTS

Indiana State Dental Society.

The forty-fifth annual meeting of the Indiana State Dental Association will be held at Indianapolis June 30, July 1, 2, 1903. Indiana extends a cordial welcome to the profession.

Rushville, Ind. F. R. McClanahan, Secy.

Massachusetts Dental Society.

The thirty-ninth annual meeting of the Massachusetts Dental Society will be held in Boston (Mechanics Building) June 3 and 4, 1903.

Edgar O. Kinsman, Secy.

15 Brattle Square, Cambridge, Mass.

New York State Dental Society.

The thirty-fifth annual meeting of the New York State Dental Society will be held Wednesday and Thursday, May 13 and 14, 1903, in the Assembly Hall, Hotel Ten Eyck, Albany, N. Y. The following well known members of the profession will present papers on subjects to be announced: E. C. Kirk, D.D.S., Philadelphia, Pa.; M. H. Cryer, D.D.S., Philadelphia, Pa.; M. L. Rhein, D.D.S., New York City, N. Y.; E. J. Line, D.D.S., Rochester, N. Y.; R. M. Sanger, D.D.S., East Orange, N. J.; J. F. Knapp, D.D.S., Geneva, N. Y.; F. T. Van Woert, D.D.S., Brooklyn, N. Y.; H. D. Hatch, D.D.S., New York City, N. Y.; A. R. Cooke, D.D.S., Syracuse, N. Y.

Exhibitors desiring space will communicate with Dr. J. L. Appleton, 89 Columbia street, Albany, N. Y. Members of the profession are cordially invited. Headquarters, Hotel Ten Eyck.

R. H. Hofheinz, D.D.S., Pres., Rochester, N. Y.

W. A. White, D.D.S., Secy, Phelps, N. Y.

Vermont State Dental Society.

The twenty-seventh annual meeting of the Vermont State Dental Society will be held at the Van Ness House, Burlington, March 18, 19, 20.

Delaware State Dental Society.

There will be a regular meeting of the Delaware State Dental Society on Wednesday, March 4. Regular meetings are held on the first Wednesdays in March, June, September and December of each year.

Wilmington, Del. R. H. JONES, Secy.

Odontological Society of Western Pennsylvania.

The Odontological Society of Western Pennsylvania will meet in Pittsburg, Pa., Tuesday and Wednesday, March 10 and 11, when it is expected to have the largest meeting of any in the history of the society.

The Executive Committee are arranging with some of our best lecturers to be in attendance, as well as a great number of exhibitors, making it the most successful meeting ever enjoyed.

C. B. BRATT, President.

B. M. LOAR, Secretary.

Michigan State Board of Dental Examiners.

The next meeting of the Michigan State Board of Examiners in Dentistry will be held in Grand Rapids, May 12, 1903, and following days.

Petoskey, Mich. CHAS. J. GRAY, Secy.

Maryland State Dental Association.

The next quarterly clinic of the Maryland State Dental Association will be held in Baltimore on the 28th of March, 1903.

Baltimore, Md. F. F. DREW, Secy.

Pennsylvania State Dental Society.

The Pennsylvania State Dental Society will hold its thirty-fifth annual meeting at Harveys Lake, July 7, 8 and 9.

VICTOR S. JONES, Secy.

Bethlehem, Pa.